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Application of Modern Technology for the Evaluation of Balance in Children of Lower Forms of Primary School

Sanja LJUBIČIĆ
Faculty of Teacher Education, University of Rijeka, Croatia
sanja_ljubicic@yahoo.com
Biljana TRAJKOVSKI
Faculty of Teacher Education, University of Rijeka, Croatia
biljana.trajkovski@ufri.uniri.hr
Ljubomir ANTEKOLOVIĆ
Faculty of Kinesiology, University of Zagreb, Croatia
ljubomir.antekolovic@kif.hr

Abstract

In the world of fast progress of information and communication technology, teachers have a responsibility to use technologies. Technological advances do not shy away from being applied in Physical Education classes because quality diagnostics of motor skills is the foundation of planning and programming transformation processes. The purpose of this paper is to determine whether there is a difference between boys and girls in expressing static balance on an individual (unilateral) leg of the dominant leg (reflex leg) on the application of modern technology as an example of good practice. 80 children in lower forms of primary school (38 boys and 42 girls, 7-10 years of age) participated in this research. Measurements of the static unilateral balance were carried out using the Gyko Inertial System (Microgate, Bolzano, Italy). The unilateral test of static balance was performed, with three attempts in 20 seconds. The following variable was total body trajectory in the unilateral balance test and morphological variables: body weight and body height. For all variables, the baseline descriptive parameters were calculated and the non-parametric method of the Mann-Whitney U-test was used to determine the statistical significance between boys and girls. Data analysis showed a statistically significant difference between boys and girls in the unilateral balance test. Girls showed a lower overall variability, i.e., smaller body trajectories than boys. The research results point to significant gender differences in the performance of the unilateral balance tests in children aged 7-10 years in favor of better results in girls. Further research should include an analysis of a larger sample of older children, closer to puberty.

Key words: *modern technology, balance, early school-aged children*

1. Introduction

Today's education of children as well as educational workers is increasingly moving in the direction of "digital learning," which is in line with the technological changes that are happening nowadays at a high speed. What we experience as modern technology can be as normal to our students as the TV is to us. Technology is everything that surrounds us, and it defines and shapes our history, everyday life, and the future. As educators in a digitized world, we have the moral responsibility to deal with technologies so that we can direct the students towards their proper use (Jandrić, 2014). Technological advancements are not left out from Physical Education classes because quality diagnostics of motor skills are the foundation for planning and programming transformation processes. Although there are sophisticated measuring instruments that offer more detailed diagnosis of children, they are generally not purchased due to a large number of limiting factors.

Given the fact that balance is the ability responsible for the successful performance of almost all movements or motor tasks that must be manifested through muscle activation (Zekić and Vučetić, 2016), the importance of its diagnostics has been recognized. The first sensory system developed in a child is the vestibular system, which controls the sensation of movement and balance and is considered the most important system that affects the daily movement and action against gravity (Hannaford, 2007). The central nervous system uses information obtained from the vestibular, visual system, and peripheral receptors to create a kind of algorithm based on which it plans and performs movements to maintain a balanced position (Trošt Bobić, 2012). Consequently, functional balance in children is defined as the ability to maintain the center of mass with respect to the base of support during typical childhood activities of daily living, school, and play (Franjoine et al., 2010). Milanović (2013) defines balance as the ability manifested in the establishment and retention of the balance position by successfully counteracting the forces that disturb the balance, and it can be defined as *dynamic* balance and *static* balance. Pejčić and Trajkovski (2018) describe balance as the ability to maintain the body in a balanced position and the correction of movements by gravitational action, which hampers the balanced position through external factors (active disruption factors). According to Vidović (2008), balance is the ability to maintain a static position while keeping the eyes closed as well as open, that is, it is the ability to oppose gravitational forces. Balance is also the ability to maintain stable movement (dynamic balance) in strictly determined and defined conditions. Nougier et al. (1998) note that the period between the first and seventh years of age is crucial for the development of postural control, and some authors advocate the extension of this period to eight or nine years of age (Roncesvalles et al., 2005). Children use visual information for balance control differently from adults, and only after seven years do they start approaching a similar use (Riach and Hayes, 1987).

Some of the new technologies for estimating balance diagnostics include: Nintendo Wii console, BIODEX "Balance System", Fitro sway check system, Huber device, Optojump-Microgate Gyko system, TEKSCAN system, and the F-SCAN mobile device. The following standardized tests are often used in educational systems: Standing on both legs longitudinally on the balance bench with open eyes (MBAU2O), Standing on one leg longitudinally on the balance bench with open eyes (MBAU1O), Standing on two legs across the balance bench with open eyes (MBAP2O), Standing on one leg across the balance bench with open eyes (MBAP1O), Standing on both legs longitudinally on the balance bench with eyes closed (MBAU2Z), Standing on one leg longitudinally on the balance bench with eyes closed (MBAU1Z), Standing with two legs across the balance bench with eyes closed (MBAP2Z), and Standing on one leg across on the balance bench with eyes closed (MBAP1Z) (Zekić and Vučetić, 2016). However, with the development of modern technologies, more detailed and more precise yet easy to use and financially affordable information can be obtained and, today, they are finding their place in sports, recreation, and kinesiotherapy.

In "our" educational system, it can be stated that balance has lost its relevance to other motor skills such as coordination, strength, flexibility, and speed. In the classroom as well as subject teaching, i.e., in the entire vertical hierarchy of the educational system, the evaluation of the balance level is not mandatory but rather depends on the will and evaluation of teachers and PE teachers. By entering the educational system, the time a child spends engaged in physical activity suddenly decreases, while the number of sedentary hours increases because school obligations have increased. During early school age (lower forms of primary school), PE education takes place three times a week in the duration of 45 minutes, which is 135 minutes a week (2 hours and 15 minutes). This fact indicates at not enough movement that would maintain a high quality health status of an individual if the child does not engage in some extracurricular physical activity through his/her own volition. The problem continues because the number of PE hours in the later stages of schooling is reduced to two hours a week and is carried out very often under very limited conditions.

A timely diagnostics of motor abilities can prevent motor deficits and lateral asymmetries, for example, of the ankle or knee joint, which increase the risk of more serious and frequent injuries in later stages of growth. Practicing balance is also essential in the rehabilitation of injuries to the above-mentioned joints (ankle joint and knee joint). In addition to prevention and rehabilitation, balance practice is also used to improve motor performance, especially muscle strength (Taube, Gruber, and Gollhofer, 2008). Balancing practice encourages adjustments in all sensory systems that assist in postural control, such as vestibular, visual, and somatosensory systems, as well as in muscular output control systems (Taube, Gruber, and Gollhofer, 2008). The importance of determining differences in the balance between boys and girls is reflected in identifying possible deficits in a particular group or a group with which the program is implemented. Given that balance as a capability is the basis of the development of other motor skills and of the acquisition and refinement of motor skills, it is important to deal with this issue. Identifying gender differences in the balance level can provide information on whether the program that is being implemented is going in the desired direction or not. Often, staff in physical education predominantly give activities such as playing football or basketball to boys, while girls are given activities of dance structures or gymnastics, i.e. those that dominantly develop balance, which results in expectedly better results in balance. In this way changes in exercise programs can be made timely so that backlog does not become even greater.

Based on the aforementioned, the importance of early balance diagnostics in children of lower forms of primary school has been recognized and, given the "modern" way of life, the aim of this paper is to present the results of research encompassing the use modern technology as an example of good practice. In further research, balance should be analyzed on a larger sample and on multiple variables (e.g., anterior-posterior and medio-lateral body trajectory estimation) and older children, closer to puberty.

The purpose of this paper is to present the results of the research on the application of modern technology as an example of good practice, i.e., to analyze and present the differences between boys and girls in the unilateral static balance of the dominant leg (reflex leg).

2. Methods

2.1. Sample of participants

Eighty early-school-aged children (38 boys and 42 girls): 10 years; 14 girls and 12 boys, 9 years; 17 girls and 18 boys, 8 years; 10 girls and 8 boys, 7 years: 1 girl and 0 boys participated in this research. The participants are the members of the "Kvarner" athletics club from Rijeka.

2.2. Pattern of variables

From the morphological variables, two variables were observed: body weight and body height, and total body trajectory in the unilateral reflex leg balance test.

2.3. Measurements

Parental consent was obtained before conducting the research. Prior to the beginning of the test, the participants conducted a 10-minute standardized warm-up and were familiarised with the test protocol. The measurement of the static unilateral balance with the dominant leg (reflex leg) was performed using the Gyko Inertial System (Microgate, Bolzano, Italy). Three attempts were measured in 20 seconds. The participant's reflex leg was determined earlier in the training sessions. The Gyko sensor was placed on the trunk (picture 1), and on the sound signal the participant began with the activity of raising the leg from the base, while a sound signal was given after 20 seconds.

2.4. Data processing

Data processing was carried out using the program package Statistica 14.0. Baseline descriptive parameters were calculated for all variables and the non-parametric method of the Mann-Whitneyev U test was used to determine the statistical significance between boys and girls.

3. Results

Table 1 shows the basic descriptive parameters: arithmetic mean, minimum and maximum score, and standard deviation in two morphological variables: body weight and body height. Girls are on average taller (134.94 cm) than boys (134.23 cm), while boys are slightly heavier (31.32 kg) than girls (30.58 kg). In the minimum values, the girls and the boys have almost the same values in body height (BH_ming = 121.1, BH_minb = 121.2), while girls still have less minimal bodyweight values than boys (BW_ming = 18.8, BW_minb = 22,70). The girls' maximal values are lower (BH_maxg = 151.50) than the boys' values by 3.5 cm (BH_maxb = 154.00) and, accordingly, the boys are heavier than the girls (BW_maxb = 44.80, BW_maxg = 47.30)

TABLE 1. DESCRIPTIVE PARAMETERS OF THE MORPHOLOGICAL VARIABLES

		MEAN	*MINIMUM*	*MAXIMUM*	*STD. DEV.*
GIRLS AND BOYS TOGETHER	BODY HEIGHT (CM)	134.59	121.10	154.00	8,13
	BODY WEIGHT (KG)	30.93	18.80	47.30	6,46
GIRLS	BODY HEIGHT (CM)	134.94	121.10	151.50	7.64
	BODY WEIGHT (KG)	30.58	18.80	47.30	6.93
BOYS	BODY HEIGHT (CM)	134.23	121.20	154.00	8.71
	BODY WEIGHT (KG)	31.32	22.70	44.80	5.96

Descriptive statistics of the values obtained were performed when measuring the total body trajectory. In Table 2 it is evident that the girls and the boys achieved best results in the first attempt (G_1 = 152.03, B_1 = 222.00), while the highest variability in boys was recorded in the third attempt (B_3 = 248.20), with girls′ variability slightly higher in the second (G_2 = 171.42) compared to the third attempt (G_3 = 171.31). In the minimum values, the girls achieved better results than the boys in the first two attempts (D_L_1_ming = 59.77; D_L_1_minb = 69.47; D_L_2_ming = 61.10; D_L_2_minb = 77.34), while in the third and last attempt the boys achieved better minimum values than the girls (D_L_3_minb = 57.73; D_L_3_ming = 60.50). Maximum values show the highest variability that occurred during the execution of the tasks. In girls, the highest variability appeared in the second attempt (D_L_2_maxg = 932.68), while in boys it occurred in the last, third attempt (D_L_3_maxb = 1116.28). With regards to the maximum values, both boys and girls achieved the lowest variability in their first attempt (D_L_1_maxg = 443.04; _D_L_1_minb = 686.77).

TABLE 2. DESCRIPTIVE PARAMETERS OF THE TOTAL BODY TRAJECTORY

VARIABLE	*MEAN*		*MINIMUM*		*MAXIMUM*		*STD. DEV.*	
	G	**B**	**G**	**B**	**G**	**B**	**G**	**B**
D_L_1 (cm)	152.03	222.00	59.77	69.47	443.04	686.77	82.95	143.82
D_L_2 (cm)	171.42	234.15	61.10	77.34	932.68	802.88	139.82	169.32
D_L_3 (cm)	171.31	248.20	60.50	57.73	913.51	1116.28	140.79	187.09
Sum_D_L (cm)	494.76	704.34	183.94	204.54	1808.78	2458.84	294.42	465.68

(D_L_1- total length of the trajectory obtained as the sum of the distances from one point to the next, G-girls, B-boys)

From Table 3, which shows the results of the Mann-Whitney test, it is evident that the values in all variables are significant. The girls have significantly lower values ($p < 0.05$) in the variability of the unilateral reflection foot balance in each separate attempt (D_L_1; U = 505.00; Z = -2,818; D_L_2; U = 541.00; Z = -2.471; D_L_3; U = 474.00, Z = -3.117) but also sum up all three attempts (Sum_D_L; U = 514.00, Z = -2.731).

TABLE 3. MANN-WHITNEY U TEST

Variable	**Rank Sum_girls**	**Rank Sum_boys**	**U**	**Z**	**2*1sided**
D_L_1	1408.00	1832.00	505.00	-2.818	0.004
D_L_2	1444.00	1796.00	541.00	-2.471	0.013
D_L_3	1377.00	1863.00	474.00	-3.117	0.002
Sum_D_L	1417.00	1823.00	514.00	-2.731	0.006

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4. Discussion

Nonparametric statistics was performed since the distribution of the variables does not meet the normality conditions, which was expected given the small sample and the high sensitivity of the measuring device. In this research, it was established that girls between the ages of 7 and 11 have a significantly better level of unilateral balance (reflex leg) than boys aged 7-10. Similar results were obtained by Alves Faco et al. (2013), who investigated the relationship between the gender and the level of system development responsible for postural balance in children between the ages of 6 and 10 years of age. They found that postural balance is better in girls than in boys, especially in eight-year-old girls. These results may indicate earlier maturation of the responsible systems in girls, which is related to their earlier entry into puberty. Erkut Atilgan et al. (2012) compared the effects of gender differences in children between the ages of 9 and 11 in performing static balance. The children were not involved in any form of organized physical exercise. 60 children took part in the research, in which bilateral and unilateral static balance were measured. The main results of this research indicate that bilateral and unilateral static balance in boys is statistically significantly better than in girls. They explained their findings with the possibility that boys are more physically active than girls, which increases muscle strength and positively affects the balance. Saygn et al. (2006) and Arabaci (2009) supported this argument by noting that, in their country, boys lead a more active life than girls. In the research of Nolan, Grigorenko, and Thorstensson (2005), which focuses on determining gender and chronological differences in static balance, it was found that boys aged 9 to 10 show higher oscillations in the center of pressure (COP) variable.

In his research, Cratty (1970) points to the possibility that the maturation of neurological, visual, vestibular, and proprioceptive systems occurs earlier in girls, which enables a more effective performance of more complex tasks such as unilateral balance. Malina (2002) states that girls of any age usually have a higher level of maturation when compared to boys of the same chronological age. Moreover, research conducted by Smith, Wong, and Ulmer (2012) and Lee and Lin (2007) found that girls aged 8-12 and 9-11 have better postural stability than boys. Dorneles, Pranke, and

Mota (2013) compared the level of balance of boys and girls aged 10 to 19 due to the fact that this stage of growth is characterized by accelerated individual growth and development. They concluded that girls had better postural control than boys. They found that the obtained results are a product of differences in anthropometric characteristics between the sexes. Certain anthropometric characteristics may also have an effect on balance distortion such as the body height, center of gravity height or body weight. In the aforementioned research, boys were on average taller than girls, pointing to a more distant center of gravity from the ground and greater oscillation in boys. Rivas and Andries (2007) and Lemos et al. (2009) stated that the body mass of women is differently distributed due to the morphological characteristics, leading to a lower center of gravity compared to males of the same body height, thereby reducing the value of postural oscillations. Lee and Lin (2007) point out that higher body weight can lead to poorer results in boys. In the research carried out by McGraw and et al. (2000), a decrease in medio-lateral stability while standing was observed in pre-puberty boys with excessive body weight compared to boys with normal body weight. Although this research did not determine the effect of body weight on the balance level, Table 1 shows that differences in body weight between boys and girls do exist. On average, boys (31.32 kg) are slightly heavier than girls (30.58 kg), which would in some way confirm the hypothesis proposed by Lee and Lin. Furthermore, in their research, Steindl et al. (2006) compared the sensory organization with postural control among children and adolescents with regards to the adult age. The results indicate that boys under 10 years of age are less focused and more agitated. All of these facts point to the complexity of this ability. Research carried out by Sá et al. (2018) leads to the conclusion that postural stability and adaptations related thereto were related to age and were under the influence of sensory manipulation. The ability of antero-posterior adaptations was more apparent, and the sensory maturation was first observed in the visual system, then in the proprioceptive system, followed by the vestibular system, reaching functional maturity at the age of nine. Though the same chronological age, girls and boys are quite different when it comes to their biological age. The girls reach the peak height velocity approximately two years before boys (Malina et al., 2004), which is an indicator of the biological maturity of the child and coincides with the year of the greatest development of the majority of the child's cognitive abilities (Erceg et al., 2013). It is, therefore, logical to conclude that biologically mature children have more developed cognitive, motor, and functional abilities, reach their peak height and weight gain earlier, and have better emotional control. Determining the static unilateral balance in early school age is important because children with a low level of static balance lack the "stabilizing framework" necessary for the development of basic functional activities (Tsai et al., 2008). Research conducted with pre-school children are in line with the obtained results that girls and boys differ significantly in their balance ability, whereby girls achieve better results than boys (De Privitellio et al., 2007, Caput Jogunica, Lončarić, and De Privitellio, 2009, Jertec, 2010). Apart from the fact that relevant systems achieve maturation earlier in girls, some of the arguments can also be analyzed in the context of the activities of children aged 7-10. Boys are mostly focused on activities like football, running, jumping, climbing, while girls pay more attention to the so-called "calmer" activities that require rhythm, coordination, balance, and precision (dance, rhythm, elastics, hopscotch, walking on a balance bench). Fujiware et al. (2011) found that the increase of postural adaptability may be related to physical and sports experiences. From a kinesiological point of view, it is desirable that girls and boys engage in as many different contents as possible to achieve a multitude of developments, regardless of the social gender paradigm based on the content, although such differences are very noticeable in children of lower forms of primary school. Multifaceted development is the foundation for further motor skills improvement.

Furthermore, Table 2 shows that both girls and boys achieved best results in the first attempt ($G\_1 = 152.03$, $B\_1 = 222.00$), while the highest variability in boys was recorded in the third attempt ($B\_3 = 248.20$), and in girls the variability was slightly higher in the second attempt ($G\_2 = 171.42$) when compared to the third one ($G\_3 = 171.31$). Such results were expected, most likely due to the participants' muscle fatigue and, with fatigue signs appearing slightly sooner in girls than in boys. Muscular fatigue is a key factor that can affect the weakening of proprioception and postural control. Fatigue impacts the ability to create muscle strength, which ultimately leads to reduced task performance (Shimpi Apurv et al., 2014). The same authors conducted a study aimed at the uncovering the effects of induced muscular fatigue on the balance and core strength. The study included 60 participants aged 18 to 25, who were tested before and after the training session. The participants who had suffered from muscular-bone lesion of the lower extremities or head injury in the last six months could not be included in the study. It was concluded that fatigue most certainly plays a role in the reduction of static balance, dynamic balance, and lumbar strength. Furthermore, Griblle and Hertel (2004) carried out a study of the effects of fatigue of the lower extremities on postural control during the implementation of unilateral static balance. The results of this study indicate that knee and hip fatigue leads to a distortion of postural control in the frontal plane, while ankle joint fatigue does not. In the sagittal plane, fatigue in all three lower extremities (ankle joint, knee joint, and hip) contributes to the distortion of postural control.

Assaiante et al. (2005) point out that, while observing the appearance of postural strategies in maintaining balance, it is necessary to differentiate the results that can be explained by biomechanical reasons from those that reflect the maturation of the central nervous system.

The participants were measured using the Gyko system, whereby, besides the measured variables on the total body trajectory, we can gain insight into more detailed balance diagnostics such as anterior-posterior (AP) and medio-lateral (ML) body trajectory. In addition to these variables, the system is also commonly used for evaluations of stability and balance in maintaining a stable posture, in movement, or in different types of jumps according to measurement protocols. In this regard, the main data obtained in the research of Tsai et al. (2008) was that the ability to control balance in both directions, AP and ML, was poorer in students with the Developmental Coordination Disorder than in children with normal development. In accordance with the previous research, a need is highlighted to establish more detailed variables regarding the unilateral static balance at early school age in order to identify possible deviations or asymmetries of the locomotor system. The application of modern technology has become a necessity in PE classes (in the educational system) and not just for sports, recreation, and rehabilitation purposes. Although the new curricular reform should contribute to this, the fact is that according to the results of the research "The European Childhood Obesity Surveillance Initiative, Croatia 2015/2016" (six through nine years of age), 31% of girls and 38.7% of boys in the Republic Croatia have excessive body mass and weight. According to the statistics, we are among the top five European countries with this problem. The Gyko system can in particular give precise insight into random bodies in all ways, which cannot be obtained by traditional tests. Such feedback can help guide the implementation of exercise plans and programs in the selection of motor content, while the examples of traditional tests can only indicate a level of balance in general. Furthemore, it was the children in the vest clouds that contained the sensor and the sound signal that marked the beginning and end of activity, which aroused great interest and motivation among the children. Furthermore, immediately after completing the test, the results are immediately visible to the computer in a numerical and graphic form, while the easy- to- save system remembers all the results. In this way, they can monitor the results very precisely and see in which way progress has been made.

5. Conclusion

In this research, modern technology (Gyko system) was used to evaluate the unilateral balance of the reflex leg. The application of "modern" technology sparked the interest of children, parents, and employees at the club. The task was carried out quickly, without delay, with great motivation and a willingness of the participants to perform as well as possible. Balance values obtained on a computer can be immediately compared. The Gyko system is easy to use – the participant puts on a waistcoat that contains a sensor and waits for the measurer's instructions. It was found that girls have a significantly better level of unilateral balance (reflex leg) than boys aged 7-10. According to previous research, indications for such results originate from the earlier maturation of the systems responsible for successful establishment of postural control. Some research is based on morphological characteristics: in this research, it was found that boys are on average heavier than girls, which was to be expected. It was also found that best results were achieved in the first attempt in both girls and boys due to the likely occurrence of expected muscular fatigue. In further research the balance should be analyzed on a larger sample and with multiple variables (e.g., anterior-posterior and medio-lateral body trajectory evaluation) and in older children, closer to puberty. The sedentary lifestyle increases upon enrollment at school while physical activity decreases. After a number of years of such a life different physical compensations may occur. These compensations make the movement dysfunctional, and the educational system is the ideal platform for introducing preventive and developmental tools given that, in classroom teaching, PE classes take place three times a week. Motor skills are interdependent, so, for example, reduced stability and balance affect the reduced active mobility in the functional task, power and strength as well as speed. Improvement of balance is done by sensory-motor training, with an adjustment of the content according to the age of the population with which the exercise is being conducted. Balance can also be developed in pre-school age with a variety of content that, at this age, should often be changed so as not to reach unwanted monotony in the work, which ultimately results in a lack of interest and motivation. Therefore, various aids should be included, but as the conditions and means for their application in training are often limited, workshops that include children can be organized through which practice or physical exercise aids can be created, which can be extremely interesting to children as a form of creative expression. To conclude, practicing balance is important for the development of the entire motor space, and the early school age is an ideal time for its improvement and the prevention of motor deficits.

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Primjena suvremene tehnologije za procjenu razine ravnoteže kod djece rane školske dobi

Sažetak

U svijetu brzog napretka informacijske i komunikacijske tehnologije učitelji imaju odgovornost baviti se tehnologijama. Tehnološki napredak se nužno mora primijeniti u nastavi Tjelesne i zdravstvene culture, jer kvalitetna dijagnostika motoričkih sposobnosti predstavlja temelj za planiranje i programiranje transformacijskih procesa. Svrha rada je utvrditi postojanje razlika između dječaka i djevojčica u iskazivanju statičke ravnoteže na pojedinačnoj (unilateralnoj) nozi dominantne (odrazne) noge primjenom suvremene tehnologije kao primjer dobre prakse. U istraživanju je sudjelovalo 80 djece rane školske dobi (38 dječaka i 42 djevojčice; 7-10 godina). Mjerenje statičke unilateralne ravnoteže provedeno je pomoću Gyko inercijskog sustava (Microgate, Bolzano, Italy). Unilateralni test ravnoteže proveden je u tri pokušaja po 20 sekundi. Promatrana je ukupna putanja tijela, kao i morfološke varijable: težina tijela i visina tijela. Za sve varijable izračunati su osnovni deskriptivni parametri, a za utvrđivanje statističke značajnosti između dječaka i djevojčica koristila se neparametrijska metoda Mann-Whitneyev U test. Obradom podataka utvrđeno je da postoji statistički značajna razlika između dječaka i djevojčica u testu unilateralne ravnoteže ($p<0,05$). Djevojčice imaju manji ukupni varijabilitet tj. manju putanju tijela u odnosu na dječake (AS_ž= 494,76, AS_m= 704,34). Rezultati ove studije pokazali su da postoje značajne spolne razlike tijekom izvođenja unilateralnog testa ravnoteže kod djece od 7-10 godina u korist boljih rezultata kod djevojčica. U daljnjim istraživanjima razlike bi trebalo analizirati na većem uzorku i kod djece starije životne dobi, bliže pubertetu.

Ključne riječi: *suvremena tehnologija, ravnoteža, djeca rane školske dobi*