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Gender Differences in Some Motor Abilities of Preschool Children

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Abstract

The paper presents the results of the investigation of gender differences in motor abilities of preschool boys (n=106) and girls (n=121), 6-7 years of age. Eighteen composite motor tests adapted for preschool children, three for each hypothetical latent motor dimension (coordination, flexibility, strength, agility, accuracy and balance) were used to measure motor performance of the subjects. Statistically significant gender differences in motor variables were established. In the majority of variables better results were achieved by boys, except for the variable assessing flexibility – straddle seated forward bend, in which girls performed better. The results showed that this set of variables had a relatively high discriminant power. The measures influenced by the motion regulation mechanism had the greatest contribution to the discriminant function. The results indicate occurrence of sexual dimorphism in children's motor abilities even at the age of six and half years.

Key words: *preschool age; sexual differences; sexual dimorphism*

Introduction

Determining the structure of anthropological dimensions of a preschool child is a serious research challenge. In the field of biological anthropology, a part related to the interdisciplinary investigation of physical activities is called kinanthroplogy (Mišigoj–Duraković, 2008). It is a scientific discipline focused on the research of the variability of human characteristics and abilities when related to physical activity, physical exercise and sports. These research endeavours, undertaken from both the biological as well as psychological, cultural and social aspects, examine intraindividual variability

of a series of features and abilities known as dimensions, over the life span (Mišigoj–Duraković, 2008). Numerous research studies conducted on samples extracted from younger, middle-aged and older populations show that human morphological, motor and energy supply dimensions are interdependent, and that under the influence of various kinesiological programmes quantitative and qualitative changes occur, affecting the dimensions themselves as well as their relationships (Ismail, 1976). During a child's growth, especially at the preschool age, the structure of particular dimensions is constantly changing within the dimension itself and between them (Bala, 2003a). These changes are primarily conditioned by the beginnings and ends of certain developmental periods (Bilić, 2007) as well as by children's individual characteristics (Bala, 2003b). Furthermore, at the end of the second developmental period sexual dimorphism in certain kinanthropological dimensions can be noticed (Bala et al., 2009; Horvat et al., 2010). The interaction, the nature and intensity of that interaction, between individual characteristics and abilities is responsible for the total development of a child, not only in its physical sense, but also for its cognitive, emotional and social aspects. Therefore, each and every environmental influence affects the overall child's being and personality. Adequate underpinning influence on physical development of a child is only possible if the body of knowledge about children's kinanthropological dimensions should allow a proper insight into them and their variability. A sedentary way of living in combination with inadequate nutrition, which is characterized by a poor selection of foods and a high intake of calories, has detrimental effects on children's growth and development. Namely, this hypokinesis is manifested as a continuous enhancement of average values obtained in the measurements of children's body volume and body mass (BMI, FFM, body mass, measures of subcutaneous fatty tissue, body parts circumferences) (Abalkhail, 2002; Datar & Sturm, 2004; Horvat et al., 2009).

Research on motor abilities of preschool children has a relatively long history. The first research of throwing a ball at a moving and stationary target was conducted in the first half of the 20th century (Hicks, 1930). A few years later, Cowan et al. (Bala et al., 2009) checked if jumping over an obstacle could be used as a development–supporting exercise and diagnostic test assessing the development level of coordination.

A deficit of motor activities or their complete absence during children's growth cannot be recovered in later periods of growth development and maturation. Namely, the influence of various kinesiological stimuli on a child gradually weakens over the years of growth and maturation (the so called critical phases). Insufficient motor experience and opportunities for participation in kinesiological activities, that is, in all kinds of programmed physical exercise, can slow down a child's motor and intellectual development (Kelly & Kelly, 1985; Humphrey, 1991).

Therefore, in order to properly design kinesiological programmes for preschool children, educators must have an insight into kinanthropological dimensions of their protégés. In the current research that means the determination of the structure of motor

abilities and the definition of a possible sexual dimorphism among preschool children. A more objective definition of possible gender differences in morphological abilities and motor characteristics would facilitate the definition of certain standards and norms, which are essential prerequisites for an adequate design of preschool physical education plans and programmes. Findings of the research that would point to certain gender differences would certainly be only a starting point for further research.

Methodology

Subjects

From the Croatian population of kindergarten children in an urban environment (cities of Zagreb and Varaždin), a random sample of 227 children, 106 boys and 121 girls, was measured. At the time of the research the children were 6.5 years ± 6 months old. For each subject involved in the sample a written consent by his/her parent or guardian was obtained, allowing their children to participate in the research, which was in compliance with the Code of Ethics prepared by the counselling body Children Council of the Government of the Republic of Croatia (2003).

Variables

Motor abilities of the subject sample were assessed using a set of eighteen composite motor tests known in the area of physical education because they are usually used to assess motor and energy supply abilities of school children. However, for the present research they had been modified to comply with the capabilities of preschool children (Horvat, 2010). Generally, all measurement courses and measurement periods were shortened and the number of stands was reduced. Also, one tryout was introduced before each test performance.

The tests assessed latent dimensions of coordination, flexibility, strength, agility, accuracy and balance in preschool girls and boys 6-7 years of age. For each of the latent dimensions there were three composite tests used, which were performed three times. The following variables were measured:

Coordination

– *pushing a ball around 2 stands with hands* (MKGR) – a 4 m course; stands were on the 2nd and 4th m from the start line; the starting line is also the finishing line; time an examinee needs to cover the course while fulfilling the task correctly with his/her hands (dominant preferably) is measured in the tenth of a second; if an examinee loses control over the ball, the task is resumed from the place where control has been lost; the test is performed three times and the results of all three trials are registered;

– *pushing a ball around 2 stands with feet* (MKGN) – the same as in the previous task; the test is performed three times and the results of all three trials are registered;

– *moving backwards on all fours* (MKHN) – 6 m course; on the 3rd m from the start the top of a box is positioned; while covering the 6 m distance and overcoming the

obstacle, an examinee is not allowed to turn his/her head or glance over the shoulders; time is measured in the tenth of a second; the test is performed three times and the results of all three trials are registered.

Flexibility

– *arm backward circumduction with a stick* (MFIP) – a stick 2 cm in a diameter and 150 cm long; parallel stand hip wide; the distance between inside rims of the hands on the stick is the test result in centimetres; the test is performed three times and the results of all three trials are registered;

– *straddle seated forward bend* (MFSR) – three preparatory trunk forward swings were allowed before a final bend position; zero was on the basic line between an examinee's heels; the positive score was if a subject managed to cross over the basic line; the negative score was registered when a subject failed to do so; a distance from the basic line was measured in centimetres; the test is performed three times and the results of all three trials are registered;

– *forward bend on a bench* (MFPK) – a starting position is extended legs heel-to-heel; the maximum forward bend as touched by the tip of the middle finger is registered in centimetres; the test is performed three times and the results of all three trials are registered.

Strength/Power

– *10 m running* (MS10) – a 10 m-course; time is measured in tenth of a second; subjects ran either barefoot or in their sports shoes; the test is performed three times and the results of all three trials are registered;

– *standing long jump* (MSSD) – usual protocol; subjects jumped barefoot; the test is also performed three times and the results of all three trials are registered in centimetres;

– *sit ups* (MSPT) – a subject is lying on his/her back with the legs flexed in the knees under 90°; palms of his/her hands are on his/her stomach; a proper repetition is if the knee is touched by the shoulder; the score is the number of correct repetitions performed in 15 seconds; the test is performed three times and the results of all three trials are registered.

Agility

– *side steps* (MAKS) – a usual protocol with the exception that the test is performed with only one change of direction due to the age of the subjects; a course is 6 m long; the starting line is the finishing line; time a subjects needs to cover the course forth and back is measured in the tenth of a second; the test is performed three times and the results of all three trials are registered;

– *slalom around stands* (MAOO) – a 4 m course; stands are on the 2^{nd} and 4^{th} m from the start line; the starting line is also the finishing line; time an examinee needs to cover the course while completing the task correctly is measured in the tenth of

a second; subjects running straight back to the starting/finishing line; the test is performed three times and the results of all three trials are registered,

– *figure of eight with a bend* (MAOS) – a usual protocol; distance between 2 stands is 4 m; time is measured in the tenth of a second; the test is performed three times and the results of all three trials are registered.

Accuracy

– *shooting at the target* (MPGC) – a target, a square with the sides 40 cm long, is fixed on the wall; 10 small rag balls are thrown from a 3 m distance; the score is the number of hits (the possible range 0-10); the test is performed three times and the results of all three trials are registered;

– *shooting at a frame* (MPGO) – a box frame is positioned horizontally on the floor; 10 small rag balls are thrown from a 3 m distance; 10 attempts; the test is performed three times and the results of all three trials are registered;

– *aiming with a stick* (MPCS) – a stick 130 cm long; 3 squares with the sides long as follows: 60 cm – 1 point, 40 cm – 2 points and 20 cm – 3 points; each subject has 5 trials to achieve maximum points (the possible point range 0-15); the distance from which each subject is aiming at the target is individually tailored; the test is performed three times and the results of all three trials are registered.

Balance

– *transversal balancing on one leg* (MRJU) – a balance bench; time of keeping balance is measured in tenth of a second; the test is performed three times and the results of all three trials are registered;

– *transversal balancing on both legs* (MROP) – a balance bench; time of keeping balance is measured in tenth of a second; the test is performed three times and the results of all three trials are registered;

– *longitudinal balancing on one leg* (MRJO) – a balance bench; time of keeping balance is measured in tenth of a second; the test is performed three times and the results of all three trials are registered.

Measurement Protocol

One week before the measurement was scheduled an exercise programme was introduced consisting of the test tasks. Three times a week, in 30-minute sessions, children had the opportunity to become familiar with the motion and moving patterns they were going to perform as the future test tasks. This was done to even, as much as possible, the level of motor knowledge and skill in the future examinees and to reduce its probable impact on the results when testing motor abilities.

Motor abilities were measured during three consecutive days. At the beginning of each measurement day children were specially prepared. The preparations commenced each day with 3-minute cyclic gross movements with various tasks. Various tasks included walking (on toes, on heels, step-shuffle step-step-shuffle step), variable

rate running, and jumps (two-legged and one-legged). Afterwards, a set of general preparatory exercises (10 to 12) for the whole body were applied. The drills were selected to address those large muscle groups that were going to be under a special load in the forthcoming testing for that day.

The tests were scheduled across three days with the aim to prevent, as much as possible, the negative impact of previous tests on the performance of the subjects in the later ones. Also, fatigue was avoided as much as possible as well as loss of motivation in the examinees. Therefore, the test assessing dynamic muscular endurance or repetitive strength of the trunk (*sit ups*) was performed at the end of the measurement of each day (three measurements altogether).

Three-day Testing Schedule:

Day One – shooting at the target, arm backward circumduction with a stick, pushing a ball around 2 stands with hands, side steps, 10 m running, sit ups 1;

Day Two – shooting at a frame, straddle seated forward bend, pushing a ball around 2 stands with feet, slalom around stands, standing long jump, sit ups 2;

Day Three – aiming with a stick, forward bend on a bench, moving backwards on all fours, figure of eight with a bend, sit ups 3.

Data Analyses

The significance of the differences between the boys and the girls was checked by the multivariate analysis of variance (MANOVA) and canonical discriminant analysis. For the needs of this research statistical programme SPSS (*Statistical Package for the Social Sciences 17.0)* was used.

Results

Basic descriptive indicators of the boys and girls' measured motor abilities are shown in Table 1. The comparison of the obtained results revealed statistically significant differences between the boys and girls in the majority of the measured manifest motor ability variables. The values of the univariate F – tests and their corresponding significance levels showed that the boys and girls from this sample differed in the variables that evaluated coordination (*pushing a ball around 2 stands with feet, pushing a ball around 2 stands with hands, moving backwards on all fours*), flexibility (*straddle seated forward bend*), strength/power (*10 m running, standing long jump*), agility (*slalom around stands, figure of eight with a bend*), accuracy (*shooting at the target, shooting at a frame, aiming with a stick*), and balance (*transversal balancing on one leg, transversal balancing on both legs*). In all the listed variables the boys scored better than the girls, which was in accordance with previous research findings (Bala, 2003a; Parizkova, 1996; Seefeldt, 1980; Spodek & Saracho, 2006; Torial & Igbokwe, 1986; Zurc et al., 2005).

Table 1. *Average results of boys and girls in motor ability assessment tests – mean (M), standard deviation (SD), minimum value (Min), maximum value (Max), F–tests, p-level*

VARIABLES	Gender	M	SD	MIN	MAX	F(1.225)	p
Pushing a ball around 2 stands with hands	boys	10.70	2.47	6.35	18.00	22.04	**0.00**
	girls	12.37	2.95	6.72	20.08		
Pushing a ball around 2 stands with feet	boys	12.54	3.08	6.46	22.04	48.23	**0.00**
	girls	15.69	3.83	8.99	33.17		
Moving backwards on all fours	boys	11.37	3.06	6.30	21.40	10.25	**0.00**
	girls	12.77	3.26	6.07	20.32		
Arm backward circumduction with a stick	boys	67.22	9.29	36.33	87.67	2.75	0.10
	girls	65.02	9.35	39.00	87.67		
Straddle seated forward bend	boys	1.49	9.41	-28.67	17.67	16.48	**0.00**
	girls	-3.41	9.47	-27.67	21.33		
Forward bend on a bench	boys	1.73	4.99	-9.00	14.33	3.37	0.07
	girls	0.51	5.24	-18.33	11.67		
10 m running	boys	3.04	0.40	2.46	4.68	5.32	**0.02**
	girls	3.17	0.39	2.40	4.86		
Standing long jump	boys	107.67	17.47	61.67	145.67	24.90	**0.00**
	girls	97.06	16.20	59.67	149.00		
Sit ups	boys	7.31	2.07	2.00	14.67	1.88	0.17
	girls	6.99	2.15	0.00	14.00		
Side steps	boys	6.84	1.29	4.67	10.53	2.16	0.14
	girls	7.05	1.18	3.33	11.33		
Slalom around stands	boys	6.68	0.97	4.57	9.40	10.72	**0.00**
	girls	7.08	0.95	5.52	10.27		
Figure of eight with a bend	boys	6.20	0.95	3.96	8.55	11.33	**0.00**
	girls	6.62	0.95	4.98	9.62		
Shooting at the target	boys	5.88	1.64	2.00	9.67	30.64	**0.00**
	girls	4.60	1.83	0.00	8.67		
Shooting at a frame	boys	4.14	1.44	0.67	8.33	15.93	**0.00**
	girls	3.42	1.39	0.33	8.00		
Aiming with a stick	boys	11.14	1.92	5.67	15.00	11.55	**0.00**
	girls	10.22	2.15	2.11	14.00		
Transversal balancing on one leg	boys	2.20	0.83	0.91	6.14	5.81	**0.02**
	girls	1.95	0.69	0.84	4.34		
Transversal balancing on both legs	boys	2.23	0.90	0.87	6.02	16.83	**0.00**
	girls	1.83	0.56	0.96	4.30		
Longitudinal balancing on one leg	boys	1.31	0.42	0.39	2.48	1.47	0.23
	girls	1.24	0.36	0.38	2.14		

When reviewing the results, special attention should be given to the number sign because some manifest variables were reversely scaled, such as the variables assessing coordination, agility and 10 m run. In other variables, nominally better results are more valuable.

Table 2. Canonical discriminant function

Function	Eigenvalue	Wλ	Rc	Chi^2	df	p
1	0.62	0.62	0.62	104.41	18	0.01

Legend: *Eigenvelue, Wilks` Lambda (Wλ), canonical correlation (Rc), Chi-square, degrees of freedom (df), p- level (p)*

The obtained canonical discriminant function (Table 2) confirmed statistically significant differences between boys and girls in the set of composite tests assessing motor abilities. The applied set of composite motor tests discriminates children well in terms of gender affiliation.

Table 3. *Structure of the discriminant function (df) and centroids of the groups*

VARIABLES	DF	Gender	Cdf1
Pushing a ball around 2 stands with feet	-0.59	**Boys**	0.84
Shooting at the target	0.47	**Girls**	-0.74
Standing long jump	0.42		
Pushing a ball around 2 stands with hands	-0.40		
Transversal balancing on both legs	0.35		
Straddle seated forward bend	0.34		
Shooting at a frame	0.34		
Aiming with a stick	0.29		
Figure of eight with a bend	-0.28		
Slalom around stands	-0.28		
Moving backwards on all fours	-0.27		
Transversal balancing on one leg	0.20		
10 m running	-0.20		
Forward bend on a bench	0.16		
Arm backward circumduction with a stick	0.14		
Side steps	-0.12		
Sit-ups	0.12		
Longitudinal balancing on one leg	0.10		

The structure of the obtained discriminant function is presented in Table 3. Based on the structure of the discriminant factor, which is defined by the correlations of the variables assessing motor abilities of the children from the sample, and on the position of the group centroids it is feasible to conclude that the variable *pushing a ball around 2 stands with feet* has the strongest discriminant power. Values of this variable are considerably better among boys than girls.

Table 4. *Predicted group membership*

Gender	Boys	Girls	Total
Boys	78.3% 83	21.7% 23	100% 106
Girls	23.1% 28	76.9% 93	100% 121

Table 4 presents the results of all the classifications of boys and girls according to the discriminant function. Out of 106 boys from the sample, 83 were well classified,

or 78% of the sample was properly classified. In the subsample of girls, 93 girls, i.e. 77% of the sample were properly classified. These results also corroborate high discriminant value of the applied set of composite tests aimed at assessing motor abilities in preschool children.

Discussion

The findings of the present research are in line with the findings of previous research studies which have demonstrated that boys of this age (6-7 years) score better than girls in most tests assessing motor abilities, especially in the motor dimensions under the primary influence of the movement regulatory mechanism (coordination, agility and balance) and energy supply regulation mechanism (strength/power). Girls at this age and older achieve better results in measures assessing flexibility (Brodie & Royce, 1998; De Privitellio et al., 2007), which is an ability primarily under the influence of the synergy and tonus regulation mechanisms. In the present research the variable *straddle seated forward bend* is the only flexibility test which statistically significantly discriminated boys from girls. Other flexibility tests did not result in any statistically significant gender differences. Namely, when conducting research with samples of preschoolers, one must be very careful how tests are performed, in which order they are applied, how the tasks are presented to the children and what the duration of the measurement sessions is. If any of the listed components is not appropriate and applicable to the measured children, the obtained results might be misleading.

Apart from the mentioned, it would also be interesting to verify on the same sample the probable influence of certain anthropometric characteristics on the achievements in the same proposed tests, aimed at assessing motor abilities of 6 and 7 year-old preschool children.

The results of the canonical discriminant analysis demonstrated that the proposed set of variables discriminated children well according to their gender affiliation. The discriminant function is mostly defined by the variable *pushing a ball with feet*. The values of this variable are significantly higher among boys than girls. This result is expected to a certain extent with respect to the usual choice of games in which boys participate more than girls. At this age children, especially boys, consider gender roles as absolute and unchangeable (Lobel & Menashri, 1993; Vasta et al., 2005), so when they choose certain games, they choose them in accordance with the gender typization (Katz & Ksansnak, 1994). Therefore, the obtained results may be explained by a more frequent participation of boys in ball games which may have a positive impact on achieving better results than girls.

This assumption is also confirmed by the discriminant value of the test *pushing a ball* around *2 stands with hands*, showing a slightly lower, yet significant value. The cause of this phenomenon may be the fact that girls are more involved in games in which a ball is manipulated with hands, rather than the ones where it is manipulated with feet. Again, gender typization is revealed. It would be advisable, in order to

provide a child's development as harmonious as possible, to apply kinesiological activities as to prevent gender typization as behaviour. In that way, educators might be able to target gender stereotypes in children and enhance their awareness about gender differences. Adequate selection of sports and exercise activities can underpin not only motor development of children, but also their integrated development of all anthropological characteristics in children of both genders by developing their gender related abilities, but also the abilities that are not gender typical (Bharati et al., 2009). This includes activities like bouncing, dribbling, passing, throwing and kicking balls, walking along narrow surfaces, various rhythmical exercises accompanied by music, dancing programmes and structures.

Apart from the above-mentioned variables, the variables *shooting at the target* and *standing long jump* also play an important role in discriminating boys and girls according to their assessed motor abilities. The synergy and tonus regulation mechanisms and the excitation intensity regulation mechanism are responsible for successful performance of these motor tasks. In these variables boys again achieved significantly better results than girls. It is likely that a higher level of explosive strength in boys enables them to achieve better results in shooting at the target as well. A probable cause of this phenomenon may be the age of the subjects, since the significant differentiation of motor characteristics has not yet taken place. The similar discriminatory significance was also obtained for the variables *transversal balancing with both legs, shooting at a frame* and *aiming with a stick,* the values of which are probably conditioned by the same causes as the value of the previous variable assessing accuracy. The mentioned variables are under the control of the synergy and tonus regulation mechanisms. The last variables with a significant contribution to discriminating children according to their motor abilities are variables aimed at assessing agility and body coordination (*figure of eight with a bend, moving backwards on all fours* and *slalom around stands*). It can be supposed that these composite tests are under the influence of the movement regulation mechanisms and that the obtained results for boys are probably caused by their general higher developmental level of motor abilities achieved. Both of these mechanisms are at a higher level of neural control under the control of the movement regulation mechanism. Therefore, it may be concluded that the observed gender differences in the values of various variables for the assessment of motor abilities of boys and girls at this age are, on the one hand, under significant influence of intraindividual variability of biological characteristics and capabilities and, on the other, under environmental influences like social status. The previous statement undoubtedly needs to be verified by further research.

The obtained results have shown that boys manipulated props better than girls and that they were better in those motor abilities which were under the influence of the excitation intensity regulation mechanism. The position of the group centroids of the boys and girls (mean value of the entire motor variables of boys and the entire motor variables of girls) show that there are significant differences in motor abilities among children at this age.

Conclusion

The results of this research showed that boys at this age are better than girls in the majority of the measured variables assessing motor abilities. So, boys achieved higher values in the variables influenced by the mechanism for structuring motion (body coordination, agility) and by the synergy and tonus regulation mechanisms (balance, throwing and aiming accuracy). Apart from that, they also achieved significantly better results than girls in tests that are under the influence of the mechanisms for excitation intensity regulation (explosive strength). It can be concluded that even at this age gender dimorphism occurred. Knowledge obtained from this research except for its theoretical importance may also be useful to practitioners for planning and programming the kinesiological transformation process with preschool children. It is recommended, when applying certain kinesiological activities, to focus momentary on the development of the abilities susceptible to the environmental influence and to respect gender affiliation of children.

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References

Abalkhail, B. (2002) Overweight and obesity among Saudi Arabian children and adolescents between 1994 and 2000. *Eastern Mediterranean health journa*l, 8(4/5),470–479.

Bala, G. (2003a). Kvantitativne razlike osnovnih antropometrijskih karakteristika i motoričkih sposobnosti dječaka i djevojčica u predškolskom uzrastu. *XLII Kongres antropologa Jugoslavije*, Sombor, Srbija, Izvodi saopštenja, 72.

Bala, G. (2003b). Quantitative differences in motor abilities of preschool boys and girls. *Kinesiologia Slovenika*, 9(2), 5-16.

Bala, G., Popović, B., & Jakšić, D. (2009). Trend of changes of general motor ability structure in pre-school children. In M. MikalaŁki (Ed.), *Proceedings Book of 1st International Scientific Conference "Exercise and Quality of Life"*, (pp.113-118). Novi Sad: Faculty of Sport and Physical Education. ISBN 978-86-80231-63-1

Bharati, P., Bharati, S., Pal, M., Chakrabarty, S., Som, S., & Gupta, R. (2009). Growth and nutritional status of pre-school children in India: rural-urban and gender differences. *Collegium Antropologicum,* 33(1), 7-21.

Bilić, Ž. (2007) Razine biološkog potencijala djece na početku osnovne škole. [Levels of biological potential with the children at the beginning of their primary school education]. *Acta Kinesiologica*, 1(1), 5-10.

Brodie, D. A., & Royce, J. (1998). Developing flexibility during childhood and adolescence. In E. Van Praagh (Ed.), *Pediatric anaerobic performance*, (pp. 65-93). Champaign, IL: Human Kinetics.

Cowan, A.E., & Pratt, B. M. (1934). The Hurdle Jump as a Developmental and Diagnostic Test of Motor Coordination for Children from Three to Twelve Years of Age. *Child Development*. 5(2),107-121.

Datar, A., & Sturm R., (2004). Physical education in elementary school and body mass index: evidence from the early childhood longitudinal study. *American Journal of Public Health*. 94(9), 1501-1506.

De Privitellio, S., Caput-Jogunica, R., Gulan, G., & Bosch, V. (2007). The influence of controlled sports activation on motor capabilities in preschool children. *Medicina,* 43, 204-209.

Hicks, A. J. (1930). The Acquisition of Motor Skill in Young Children. A Study of the Effects of Practice in Throwing at Moving Target, *Child Development* 1(2), 90-105.

Horvat, V. (2010). *Relacije između morfoloških i motoričkih dimenzija te spremnosti za školu djece predškolske dobi.* (Doctoral dissertation, Faculty of Kinesiology, University of Zagreb) Zagreb: Faculty of Kinesiology, University of Zagreb.

Horvat, V., Breslauer, N., & Miščanjčuk, M. (2010). Factor Structure of Motor Abilities of 6.5-Year-Old Boys and Girls. In M. Kovač, G. Jurak, & G. Starc, (Eds.) "*Proceedings of the 5th International Congress Youth Sport 2010"* (pp. 223-228). Ljubljana: Faculty of Sport, University of Ljubljana. ISBN: 978-961-6843-10-2

Horvat, V., Jenko Miholić, S., & Blažević, K. (2009). Metric characteristics of tests for assessing balance in preschool children. In I.Prskalo, V.Findak, & J.Strel (Eds.) "*3rd Special Focus Symposium: Kinesiological education – heading towards the future*" (pp. 75-82). Zadar: Faculty of Teacher Education, University of Zagreb.

Horvat, V., Mišigoj-Duraković, M., & Prskalo, I. (2009). Body Size and Body Composition Change Trend sin Preschool Children over a Period of Five Years. *Collegium Antropologicum*, 33(1), 99-103.

Humphrey, J. H. (1991). *An Overview of Childhood Fitness*. Springfield, Illinois: Charles C. Thomas Publisher.

Ismail, A. H. (1976). Integralni razvoj, teorija i eksperimentalni rezultati, *Kineziologija,* 6(1-2), 9-28

Katz, P. A., & Ksansnak, K. R. (1994). Developmental aspects of gender role flexibility and traditionality in middle childhood and adolescence. *Developmental Psychology*, 30, 272–282.

Kelly, N. T., & Kelly, B. J. (1985). *Physical Education for Pre - School and Primary Grades.* Springfield, Illinois: Charles C. Thomas Publisher.

Lobel, T. E., & Menashri, J. (1993). The relations of conceptions of gender-role transgressions and gender constancy to gender-typed toy preferences. *Developmental Psychology*, 29, 150-155.

Mišigoj-Duraković, M. (2008). *Kinantropologija – biološki aspekti tjelesnog vježbanja*. Zagreb: Kineziološki fakultet Sveučilišta u Zagrebu.

Parizkova, J., (1996). *Nutrition, Physical Activity, and health in Early Life.* Boca Raton: CRC Press.

Seefeldt, V. (1980). Physical fitness quidebres for preschool children. *Proceedings of the National Conference on Physical Activity and Sport for All,* 5-19.

Spodek, B. & Saracho, O. N. (Eds.) (2006). *Handbook of research on the education of young children*. New York, NY: Macmillan Publishing Company

Toriola, A. L., & Igbokwe, N. U. (1986). Age and sex differences in motor performance of pre-school Nigerian children. *Journal of Sports Science*, 4(3), 219 – 227.

Vasta, R., Haith, M. M., & Miller, S. A. (2005). *Dječja psihologija*. Jastrebarsko: Naklada Slap.

Vijeće za djecu vlade Republike Hrvatske. (2003). *Etički kodeks istraživanja s djecom.* Zagreb: Državni zavod za zaštitu obitelji, materinstva i mladeži.

Zurc, J., Pišot, R., & Stojnik, V. (2005). Gender differences in motor performance in 6.5-year-old children. *Kinesiologija Slovenica*, 11(1), 90–104.

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Razlike po spolu u nekim motoričkim sposobnostima djece predškolske dobi

Sažetak

U radu su ispitane moguće razlike po spolu u motoričkim obilježjima dječaka (n=106) i djevojčica (n=121) predškolske dobi, starosti od 6 do 7 godina. U istraživanju je korištena baterija od osamnaest modificiranih testova za uzrast predškolske dobi, od kojih su za svaku latentnu dimenziju motoričkih sposobnosti bila predviđena po tri testa (koordinacija, fleksibilnost, snaga, agilnost, preciznost, ravnoteža). Utvrđene su značajne razlike po spolu između dječaka i djevojčica u mjerenim varijablama motoričkih sposobnosti. U većini varijabla bolje rezultate postizali su dječaci, osim u jednoj varijabli iz skupine procjene fleksibilnosti – pretklon u sjedu, u čemu su djevojčice bile bolje. Rezultati diskriminacijske analize potvrdili su kako taj skup manifestnih varijabli za procjenu motoričkih sposobnosti dobro razlikuje dječake i djevojčice. Najveći doprinos mogućem razlikovanju djece s obzirom na spolnu pripadnost pokazale su one varijable koje su pod utjecajem mehanizma za regulaciju kretanja. Rezultati ukazuju na to kako je već kod djece od šest i pol godina došlo do pojave spolnog dimorfizma u motoričkim sposobnostima.

Ključne riječi: *predškolska djeca; spolne razlike; spolni dimorfizam.*

Uvod

Utvrđivanje strukture različitih antropoloških dimenzija predškolskog djeteta postavlja za istraživače ozbiljan znanstveni izazov. U prostoru biološke antropologije dio koji je vezan uz interdisciplinarno proučavanje tjelesnih aktivnosti naziva se kinantropologija (Mišigoj – Duraković, 2008). To je znanstvena disciplina koja se bavi proučavanjem varijabilnosti ljudskih karakteristika i sposobnosti vezanih uz tjelesnu aktivnost, vježbanje i sport, kako s biološkog tako i s psihološkog, kulturnog i socijalnog aspekta. Ovo istraživanje proučava, gledano zajedno s biološkog, psihološkog, kulturološkog i sociološkog aspekta, intraindividualnu varijabilnost niza karakteristika i sposobnosti, najčešće zvanih dimenzijama, tijekom čovjekova životnog vijeka (Mišigoj – Duraković, 2008). Mnogi istraživači provode istraživanja

na uzorcima izdvojenim iz populaciji mlađe, srednje i starije životne dobi, pokazujući kako su morfološke, motoričke i funkcionalne dimenzije međusobno ovisne i da se pod utjecajem različitih kineziloških aktivnosti događaju kvantitativne i kvalitativne promjene, kako na samim dimenzijama tako i na njihovim međuodnosima (Ismail, 1976). Tijekom djetetova odrastanja, posebno u vrijeme predškolske dobi, struktura pojedinih antropoloških dimenzija mijenja se unutar dimenzija i između više njih (Bala, 2003a). Te promjene uvjetovane su prije svega početkom i završetkom razvoja pojedinih razvojnih razdoblja (Bilić, 2007), kao i individualnim karakteristikama djece (Bala, 2003b). Uz to se već na kraju drugoga razvojnog razdoblja pojavljuje spolni dimorfizam u pojedinim kinantropološkim dimenzijama (Bala i sur., 2009; Horvat i sur., 2010). Interakcija pojedinih osobina, njihova priroda i intenzitet, njihove interakcije između individualnih karakteristika i sposobnosti, odgovorna je za sveukupni djetetov razvoj, ne samo u tjelesnom već i u spoznajnom, emocionalnom i socijalnom aspektu. Stoga svaki vanjski utjecaj utječe na cjelokupno djetetovo biće, osobnost. Primjereni utjecaj na tjelesni razvoj djeteta moguć je samo ako bi se povećala razina znanstvenih spoznaja o prostoru kinantropoloških dimenzija djece i njihovoj varijabilnosti. Sedentarni način života u kombinaciji s neodgovarajućom prehranom, za koju je karakterističan kvalitativno loš odabir namirnica i neprimjeren unosa kalorija, za posljedicu ima štetne učinke na dječji rast i razvoj. Naime, hipokinezija se očituje kao kontinuirano povećanje prosječnih vrijednosti mjera za procjenu volumena i mase tijela djece (BMI, FFM, masa tijela, mjere potkožnog masnog tkiva, mjere opsega pojedinih dijelova tijela) (Abalkhail, 2002; Datar i Sturm, 2004; Horvat i sur., 2009).

Proučavanja motoričkih sposobnosti djece predškolske dobi počela su relativno rano. Prva istraživanja razvoja motoričkih vještina gađanja loptom u pomičnu i nepomičnu metu provedena su u prvoj polovini dvadesetog stoljeća (Hicks, 1930). Nekoliko godina poslije Cowan i suradnici (Bala i sur., 2009) provjeravali su mogućnosti primjene skoka preko prepreke kao razvojnog i dijagnostičkog testa za procjenu razine razvijenosti koordinacije.

Premala zastupljenost motoričkih aktivnosti ili njihovo potpuno odsustvo tijekom ranog djetinjstva ne može se nadoknaditi u kasnijim razvojnim razdobljima. Mogućnost utjecaja različitih kineziloških stimulusa na pojedine antropološke dimenzije tijekom odrastanja postupno slabi (kroz takozvane kritične faze). Nedostatak odgovarajućeg broja motoričkih iskustava i mogućnost sudjelovanja djece u kineziološkim aktivnostima može negativno utjecati na njihov motorički i intelektualni razvoj (Kelly i Kelly, 1985; Humphrey, 1991).

S ciljem kvalitetnog programiranja kineziloških programa za djecu predškolske dobi odgojitelji i svi oni koji rade s predškolskom djecom moraju imati uvid u kinantropološke dimenzije djece. U ovome se istraživanju to odnosi na utvrđivanje strukture motoričkih sposobnosti i nužnu provjeru mogućeg spolnog dimorfizma djece predškolske dobi. Objektivnije utvrđivanje moguće razlike prouzročene

spolnom pripadnošću u morfološkim karakteristikama i motoričkim sposobnostima omogućilo bi definiranje određenih standarda i normativa, koji bi mogli predstavljati dobru polaznu osnovu za izradu odgovarajućih planova i programa u pojedinim kineziološkim aktivnostima. Dobiveni rezultati koji bi mogli upućivati na spolni dimorfizam djece predškolske dobi bili bi samo polazište za nova istraživanja.

Metodologija

Uzorak ispitanika

Iz populacije djece polaznika vrtića koji su se nalazili u urbanim sredinama (Zagreb, Varaždin), slučajnim odabirom stvoren je uzorak koji je činilo 227 djece, 106 dječaka i 121 djevojčica. Djeca su u vrijeme istraživanja bila stara od 6,5 godina ± 6 mjeseci. Za svakog ispitanika koji je bio uključen u uzorak dobiven je pismeni pristanak roditelja/skrbnika o njihovoj suglasnosti s uključivanjem njihove djece u istraživanje, a što je u skladu s Etičkim kodeksom koji je pripremilo kao savjetodavno tijelo Vijeće za djecu Vlade Republike Hrvatske (2003).

Uzorak varijabli

Motoričke sposobnosti bile su procijenjene skupom od osamnaest kompozitnih testova poznatih u području kineziološke edukacije s obzirom na to da se njima najčešće provode testiranja motoričkih i funkcionalnih sposobnosti djece školske dobi. Za potrebe ovog istraživanja testovi su bili modificirani u skladu sa sposobnostima predškolske djece (Horvat, 2010). Generalno, sva radna mjesta, vremena za testiranje, kao i vrijeme čekanja su skraćena. Također, dopušten je bio jedan probni pokušaj prije svakog testiranja.

Testovi su procjenjivali latentne dimenzije koordinacije, fleksibilnosti, snage, agilnosti, preciznosti i ravnoteže kod predškolskih djevojčica i dječaka u dobi od 6 do 7 godina. Za svaku latentnu dimenziju bila su konstruirana tri testa koja su bila mjerena po tri puta. Mjerene su slijedeće varijable:

Koordinacija

– *guranje lopte oko stalaka boljom rukom (MKGR)* – na stazi duljine 4 m stalci su postavljeni na svaka 2 m; startna linija je također i linija cilja: mjeri se vrijeme u desetinkama sekunde koje je potrebno ispitaniku da izvede ispravno zadatak *boljom rukom;* u slučaju gubljenja kontrole nad loptom, test se mora nastaviti od mjesta gdje je kontrola izgubljena; test se ponavlja tri puta; upisuju se rezultati svih triju mjerenja

– *guranje lopte oko stalaka nogama (MKGN)* – isto kako prethodni test; test se ponavlja tri puta; upisuju se rezultati svih triju mjerenja

– *četveronožno hodanje unatrag (MKHN)* – staza duljine 6 metara; na udaljenosti 3 m od crte starta postavi se poklopac švedskog sanduka; ispitanik četveronožnim hodanjem prema natrag prelazi prostor od 6 m savladavajući prepreku; ispitanik ne smije ni u jednom trenutku okretati glavu niti gledati preko ramena; vrijeme se mjeri u desetinkama sekunde; test se ponavlja tri puta; upisuju se rezultati svih triju mjerenja

Fleksibilnost

– *iskret s palicom (MFIP)* – drvena palica promjera 2 cm, duljine 150 cm; paralelni stav u širini kukova; rezultat u testu je udaljenost između unutarnjih bridova šaka; rezultat se bilježi u cm; test se ponavlja tri puta; upisuju se rezultati svih triju mjerenja

– *pretklon u sjedu (MFSR)* – dopuštena su tri probna pretklona prije završne pozicije; nulte vrijednosti mjerne linije nalaze se u ravnini s petama; pozitivan rezultat bilježi se ako ispitanik prijeđe rukama preko osnovne linije (nulte vrijednosti); u suprotnom se bilježi negativan rezultat; bilježi se udaljenost od osnovne linije u centimetrima; test se ponavlja tri puta i upisuju se rezultati svih triju mjerenja

– *pretklon na klupi (MFPK)* – početni položaj ispitanika je stoj na klupi u stavu spetnom; mjeri se maksimalan pretklon dosegnut srednjim prstom u centimetrima; test se ponavlja tri puta i upisuju se rezultati svih triju mjerenja

Snaga

– *trčanje deset metara (MS10)* – staza od 10 m; vrijeme se mjeri u desetinkama sekunde; Ispitanik izvodi zadatak bos ili u tenisicama; test se izvodi tri puta i upisuju se rezultati svih triju pokušaja

– *skok u dalj iz mjesta (MSSD)* – uobičajen protokol; Ispitanik skače bos; test se također izvodi tri puta i upisuju se rezultati svih triju pokušaja u centimetrima

– *podizanje trupa (MSPT)* – Ispitanik leži na leđima, nogu savijenih pod kutom od 90°; dlanovi obje ruke nalaze mu se na trbuhu; ispravnim pokretom smatra se ako se ispitanik podiže iz početnog položaja u sjedeći bez pomoći ruku i to tako da ramenima dodirne koljena; rezultat je broj ponavljanja ispravnih pokreta izvedenih u vremenu od 15 sekundi; test se izvodi tri puta i upisuju se rezultati svih triju pokušaja

Agilnost

– *koraci u stranu (MAKS)* – uobičajen protokol s iznimkom što se test izvodi s jednom promjenom smjera s obzirom na dob ispitanika; staza duga 6 m; startna linija je ujedno i ciljna linija; mjeri se potrebno vrijeme u kojemu se ispitanik kreće bočnim koracima u stranu bez križanja nogu do druge crte; kada je dodirne desnom nogom ili prijeđe preko nje, zaustavlja se i ne mijenjajući položaj tijela vraća se na isti način do startne crte; test se izvodi tri puta i upisuju se rezultati svih triju pokušaja

– *obilazak oko stalaka (MAOO)* – na stazi duljine 4 m stalci su raspoređeni na udaljenosti 2 m i 4 m od crte starta; startna crta je ujedno i ciljna; mjeri se potrebno vrijeme u desetinkama sekunde da ispitanik što brže obiđe prvi stalak, nakon toga obiđe drugi stalak i vrati se na startnu crtu; test se izvodi tri puta i upisuju se rezultati svih triju pokušaja

– *osmica sa saginjanjem (MAOS)* – uobičajen protokol; udaljenost između dva stalka je 4 m, vrijeme se mjeri u desetinkama sekunde; test se izvodi tri puta i upisuju se rezultati svih triju pokušaja

Preciznost

– *gađanje lopticom u cilj (MPGC)* – meta, kvadrat sa stranicama dugim 40 cm, pričvršćena je na zid; 10 krpenih loptica baca se s udaljenosti od 3 m; rezultat je broj pogodaka u metu (rezultat može varirati od 0 do najviše 10); test se izvodi tri puta i upisuju se rezultati svih triju pokušaja

– *gađanje u okvir (MPGO)* – okvir švedskog sanduka smješten je na tlu; cilj se gađa dominantnom rukom; 10 krpenih loptica se baca s udaljenosti od 3 m; svaki ispitanik ima pravo na deset pokušaja; test se izvodi tri puta i upisuju se rezultati svih triju pokušaja

– *ciljanje štapom (MPCS)* – štap duljine 130 cm; okomita meta na kojoj se nalaze nacrtani kvadrati veličine stranica od 60 cm – 1 bod, 40 cm – 2 boda i 20 cm – 3 boda; svaki ispitanik ima 5 pokušaja da postigne maksimum bodova (raspon bodova je od 0 do 15); opruženom rukom podigne štap i dodirne metu, na podlozi se tada zabilježi linija koju ne smije prijeći tijekom izvođenja zadatka; test se izvodi tri puta i upisuju se rezultati svih triju pokušaja

Ravnoteža

– stajanje *na jednoj nozi preko klupice za ravnotežu (MRJU)* – klupica za ravnotežu; vrijeme u ravnotežnom izdržaju mjeri se u desetinkama sekunde; test se izvodi tri puta i upisuju se rezultati svih triju pokušaja

– stajanje *na obje noge preko klupice za ravnotežu (MROP)* – klupica za ravnotežu; vrijeme u ravnotežnom izdržaju mjeri se u desetinkama sekunde; test se izvodi tri puta i upisuju se rezultati svih triju pokušaja

– stajanje *na jednoj nozi uzduž klupice za ravnotežu (MRJO)* – klupica za ravnotežu; vrijeme u ravnotežnom izdržaju mjeri se u desetinkama sekunde; test se izvodi tri puta i upisuju se rezultati svih triju pokušaja

Protokol mjerenja

Tjedan dana prije termina mjerenja odrađeno je uvježbavanje u kojemu su ispitanici bili upoznati sa sadržajem testova. Tri puta tjedno u trajanju od 30 minuta djeca su imala priliku upoznati se s kretnjama koje ih očekuju u testovima. Svako dijete je na kraju uvježbavanja moralo usvojiti motoričko znanje na takvoj razini koja mu je omogućavala najbolje iskazivanje procjenjivane varijable motoričke sposobnosti.

Mjerenje motoričkih sposobnosti provodilo se tijekom tri dana. Na početku svakog mjernog dana djeca su za testiranje bila pripremana psihofizički. Pripremanje je podrazumijevalo ciklička kretanja laganim tempom u trajanju do 3 minute. Tijekom te tri minute provodile su se zadaće hodanja (na prstima, petama, korak-dokorak), trčanja različitim tempom, skakanja (sunožna i jednonožna). Nakon toga je slijedio ciklus općepripremnih vježbi (10 do 12 vježbi) odabranih s obzirom na one velike skupine mišića koje će biti posebno opterećene u testovima planiranim za taj dan.

Raspored primjenjivanja pojedinih testova tijekomtri dana napravljen je s ciljem maksimalnog izbjegavanja negativnog utjecaja mjerenja prethodnih testova na

uspješnost u izvođenju sljedećih. Na taj način se izbjegavao umor što je više moguće, kao i gubitak motivacije ispitanika. Provjera dinamičke mišićne izdržljivosti ili repetitivne snage trupa (*podizanja trupa)* odvijalo se tako da se na kraju svakog radnog dana provodilo samo jedno mjerenje kako bi se izbjegao utjecaj umora na rezultat (sveukupno su bila provedena tri mjerenja).

Dnevni raspored mjerenja:

1. dan – *gađanje lopticom u cilj, iskret s palicom, guranje lopte oko stalaka boljom rukom, koraci u stranu, trčanje deset metara, podizanje trupa* – 1
2. dan – *gađanje u okvir, pretklon u sjedu, guranje lopte oko stalaka nogama, obilazak oko stalaka, skok u dalj iz mjesta, podizanje trupa* – 2
3. dan – *ciljanje štapom, pretklon na klupi, četveronožno hodanje unatrag, osmica sa saginjanjem, podizanje trupa* – 3

Statističke analize

Značajnost razlika u vrijednostima manifestnih varijabli za procjenu motoričkih sposobnosti između dječaka i djevojčica provjerena je multivarijantnom analizom varijance (MANOVA) te kanoničkom diskriminativnom analizom. Za potrebe ovog istraživanja korišten je statistički program SPSS (*Statistical Package for the Social Sciences 17.0).*

Rezultati

Osnovni deskriptivni pokazatelji mjerenih motoričkih obilježja dječaka i djevojčica prikazani su u tablici 1. Usporedbom dobivenih rezultata može se utvrditi da postoje statističke značajne razlike između dječaka i djevojčica u većini mjerenih manifestnih varijabli motoričkih sposobnosti. Tako su vrijednosti univarijatnih F – testova te njihove pripadajuće razine značajnosti pokazale da se dječaci i djevojčice iz ovog uzorka razlikuju u varijablama koje procjenjuju koordinaciju (*guranje lopte oko stalaka nogama, guranje lopte oko stalaka boljom rukom, četveronožno hodanje unatrag*), fleksibilnost (*pretklon u sjedu*), snagu (*trčanje deset metara, skok udalj iz mjesta*), agilnost (*obilazak oko stalaka, osmica sa saginjanjem*), preciznost (*gađanje lopticom u cilj, gađanje u okvir, ciljanje štapom*) i ravnotežu (stajanje *na jednoj nozi preko klupice za ravnotežu, s*tajanje *na obje noge preko klupice za ravnotežu*). U svim navedenim varijablama dječaci imaju bolje vrijednosti rezultata, a što potvrđuju i dosadašnja istraživanja (Bala, 2003a; Parizkova, 1996; Seefeldt, 1980; Spodek i Saracho, 2006; Torial i Igbokwe, 1986; Zurc i sur., 2005).

Tablica 1.

Prilikom pregleda rezultata treba obratiti pažnju na obrnuto skalirane rezultate kao npr. kod varijabli za procjenu koordinacije, agilnosti i testa trčanja na deset metara. U ostalim mjerenim varijablama nominalno bolji rezultati su i vredniji.

Tablica 2.

Dobivena kanonička diskriminacijska funkcija koja se nalazi u tablici 2 utvrđuje statistički značajnu razliku između dječaka i djevojčica u mjerenom skupu kompozitnih testova motoričkih sposobnosti. Očigledno kako ova baterija kompozitnih testova motoričkih sposobnosti dobro diskriminira djecu s obzirom na spolnu pripadnost.

Tablica 3.

Struktura diskriminacijskih funkcija vidljiva je u tablici 3. Na osnovi strukture diskriminativnog faktora, koja je definirana korelacijama mjerenih varijabli motoričkih sposobnosti djece iz uzorka, te na osnovi položaja centroida, može se uočiti da djecu najbolje diskriminira varijabla *guranje lopte nogama*. Vrijednosti te varijable značajno su bolje kod dječaka nego kod djevojčica.

Tablica 4.

Tablica 4 prikazuje rezultate klasificiranja dječaka i djevojčica na temelju diskriminacijske funkcije. Od 106 dječaka koji su činili uzorak 83 su dobro klasificirana, što izraženo u postocima čini oko 78% uzorka. Za razliku od njih, 93 djevojčice su dobro klasificirane, što u postotku iznosi 77%. I ti rezultati potvrđuju relativno visoku diskriminacijsku vrijednost primijenjenog skupa kompozitnih testova za procjenu motoričkih sposobnosti djece predškolske dobi.

Diskusija

Dobivene vrijednosti u skladu su s rezultatima dosadašnjih istraživanja u kojima se tvrdi kako dječaci u ovom dobnom uzrastu (od 6 do 7 godina starosti) imaju bolje rezultate u većini motoričkih sposobnosti od djevojčica, i to prije svega u onima koje su pod utjecajem mehanizma za regulaciju kretanja (koordinacija, agilnost, ravnoteža) te mehanizma za energetsku regulaciju (snaga). Djevojčice u navedenom dobnom uzrastu, kao i u kasnijim razvojnim razdobljima, imaju bolje rezultate u mjerama koje procjenjuju fleksibilnosti (Brodie i Royce; De Privitellio i sur., 2007), a koje su prije svega pod utjecajem mehanizma za sinergijsku regulaciju i regulaciju tonusa. U ovom istraživanju *pretklon u sijedu raznožnom* jedini je test za procjenu fleksibilnosti koji statistički značajno razlikuje dječake i djevojčice. Ostali testovi za procjenu fleksibilnosti nisu pokazali statistički značajne razlike. Za vrijeme provođenja istraživanja u kojem sudjeluje populacija predškolske djece mora se voditi računa o načinu provođenja testova, njihovu redoslijedu, načinu prezentiranja zadataka, kao i o duljini trajanja mjerenja. Ako sve navedene komponente nisu primjerene djeci, rezultati koji se dobiju takvim istraživanjem mogu vrlo lako navesti na krive zaključke.

Uz navedeno, bilo bi zanimljivo u narednim istraživanjima provjeriti na istom uzorku moguć utjecaj pojedinih antropometrijskih karakteristika na rezultate na istim testovima kojima se procjenjuju motoričke sposobnosti predškolske djece u dobi od 6 do 7 godina starosti.

Rezultati kanoničke diskriminativne analize pokazuje kako predloženi skup varijabli dobro diskriminira djecu predškolske dobi s obzirom na pripadnost spolu. Tako

diskriminativnu funkciju definira najviše varijabla guranje lopte nogama. Rezultati ovoga testa statistički su značajniji kod ispitanika dječaka u odnosu na djevojčice. Rezultat je donekle očekivan s obzirom na uobičajen odabir igara u kojima sudjeluju dječaci za razliku od djevojčica. U tom dobnom uzrastu djeca, a pogotovo je to zamjetno kod dječaka, smatraju kako su spolne uloge nepromjenjive i apsolutne (Lobel i Menashri, 1993; Vasta i sur., 2005), tako da prilikom odabira određenih igara one moraju biti u skladu sa spolnim tipiziranjem (Katz i Ksansnak, 1994). Dobiveni rezultati mogu biti objašnjeni češćim sudjelovanjem dječaka u igrama koje koriste loptu od djevojčica, što zasigurno može značajno utjecati na postizanje boljih rezultata u testovima u kojima se ona koristi.

Tu pretpostavku potvrđuje i diskriminativna vrijednost testa *guranje lopte rukom*, koja je nešto nižih vrijednosti, no ipak značajna. Uzrok nešto niže diskriminacijske vrijednosti ovog testa može biti prije svega u tome što se u pojedinim igrama s loptom, a u kojima se ona manipulira rukama, djevojčice nešto češće uključuju, za razliku od igara u kojima se loptom manipulira nogama. Ti rezultati pokazuju kako se kod promatrane skupine djece opet pokazuje sklonost spolnom tipiziranju. Svakako bi za skladniji razvoj djece bilo nužno organizirati kineziološke aktivnosti na način preveniranja spolnog tipiziranja kao oblika ponašanja. Na taj bi se način putem različitih kineziloških aktivnosti moglo djelovati na razbijanje spolnih stereotipa kod djece i razvijati svijest o spolnim razlikama. Pravilnim odabirom aktivnosti moglo bi se djelovati na one motoričke sposobnosti koje su kod dječaka ili djevojčica kvantitativno značajnije izražene, a što bi bilo izuzetno značajno za integrirani pristup razvoju antropoloških karakteristika djece oba spola (Bharati i sur., 2009). Primjena motoričkih zadaća poput vođenja i dodavanja lopte rukama i nogama, hodanja po suženim površinama, vježbanja uz glazbenu pratnju u ritmu, raznih oblika plesnih struktura bilo bi preporučljivo koristiti što češće.

Osim navedenih varijabli u diskriminiranju dječaka i djevojčica u motoričkim sposobnostima značajno sudjeluju i varijable *gađanja u cilj* i *skok u dalj iz mjesta*. Za sposobnost izvođenja tih motoričkih gibanja odgovoran je mehanizam za sinergijsku regulaciju i regulaciju tonusa, kao i mehanizam za regulaciju intenziteta ekscitacije. U tim varijablama dječaci imaju značajno bolje rezultate. Vjerojatno viša razina razvijenosti eksplozivne snage kod dječaka omogućuje postizanje boljih rezultata i prilikom gađanja u cilj. Uzrok te pojave može biti u dobnom uzrastu ispitanika kod kojih još vjerojatno nije došlo do značajne diferencijacije motoričkih obilježja. Sličan diskriminativan značaj imaju i varijable *stajanje poprečno objema nogama, gađanje u okvir* i *ciljanje štapom,* čije su vrijednosti vjerojatno uvjetovane istim razlozima kao i rezultati prethodne varijable za procjenu faktora preciznosti. Navedene varijable su pod kontrolom mehanizma za sinergijsku regulaciju i regulaciju tonusa. Posljednje varijable koje značajnije sudjeluju u diskriminiranju djece u prostoru motoričkih sposobnosti jesu varijable za procjenu agilnosti i koordinacije tijela (*osmica sa sagibanjem, hodanje unatrag* i *obilazak oko stalaka*). Kako su ti kompozitni testovi

pod utjecajem mehanizma za strukturiranje kretanja, može se pretpostaviti kako su dobiveni rezultati kod dječaka vjerojatno uzrokovani prije svega ukupno višom razinom razvijenosti onih motoričkih sposobnosti u mjerenom razvojnom razdoblju. Ta dva mehanizma su na višoj razini pod kontrolom mehanizma za regulaciju kretanja. Iz svega proizlazi da na uočene razlike u vrijednostima pojedinih varijabli koje procjenjuju motoričke sposobnosti dječaka i djevojčica u proučenom uzrastu vjerojatno znatan utjecaj ima s jedne strane intraindividualna varijabilnost niza bioloških karakteristika, a s druge mogući vanjski utjecaji poput sociološkog statusa. Bilo bi svakako nužno provesti dodatna istraživanja kojima bi se provjerila navedena tvrdnja.

Rezultati analize pokazali su kako dječaci bolje barataju rekvizitima i da su bolji u onim motoričkim obilježjima koja su pod utjecajem mehanizma za regulaciju intenziteta ekscitacije. Položaj centroida dječaka i djevojčica (aritmetičkih sredina cjelokupnog prostora motoričkih sposobnosti dječaka i cjelokupnog prostora motoričkih sposobnosti djevojčica) pokazuje kako u proučenom dobu djece postoje značajne razlike u prostoru motoričkih sposobnosti.

Zaključak

Rezultati ovog istraživanja pokazali su da su dječaci proučenog dobnog uzrasta bolji u većini mjerenih manifestnih varijabli motoričkih sposobnosti. Tako dječaci imaju bolje vrijednosti u onim varijablama koje su pod utjecajem mehanizma za strukturiranje kretanja (koordinacija tijela, agilnost) i mehanizma za sinergijsku regulaciju i regulaciju tonusa (ravnoteža, preciznost gađanja i ciljanja). Osim toga, značajno bolje rezultate postižu i u testovima koji su pod utjecajem mehanizma za regulaciju intenziteta ekscitacije (eksplozivna snaga). Može se zaključiti kako je već u proučenom uzrastu došlo do pojave spolnog dimorfizma. Spoznaje proizašle iz ovog istraživanja osim teorijskog značaja mogu biti korisne i praktičarima prilikom planiranja i programiranja kineziološkiх aktivnosti s djecom predškolske dobi. Svakako bi bilo preporučljivo prilikom primjenjivanja pojedinih kineziološkiх aktivnosti obratiti pažnju na razvoj onih motoričkih sposobnosti koje su u datom trenutku osjetljive na vanjske utjecaje, osobito vodeći računa o spolu djece.

Napomena

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