Research in Kinesiology
2015, Vol. 43, No. 1, pp. 115-121

MANIFESTATION, MEASUREMENT AND ASSESMENT OF BALANCE IN 7 YEAR OLD CHILDREN

Original scientific paper

Biljana Popeska, Snezana Jovanova - Mitkovska and Kiril Barbareev
University Goce Delcev - Štip, Faculty of Educational sciences, Štip, Macedonia

Abstract

In this work we made an elaboration of theoretical and practical aspects in manifestation, *measurement and assessment of balance in 7 year old children, as well as the representation of balance in PE contents in national PHE curriculum for second grade students. Presented knowledge has been obtained in a research realized on a sample of 123 male examinees, 7 year old children, second grade students in 5 primary schools in Skopje, Macedonia. Using adequate statistical methods we determined the manifestation of balance in children latent motor space, characteristics of test used for estimation of balance as well as norms for following and assessment of children`s achievements in suggested tests as a foundation for following and assessment in PE teaching process and creation of final grade for PHE. Following tests were used: Walking on upturned Swedish bench (RAOSK), Standing on a bench in width (RASKS) and Standing on a bench in length (RASKD). Obtained results point out a great variability of results, high coefficients for reliability and satisfactory validity of applied tests. According to this results, the test Walking on upturned Swedish bench (RAOSK), is recommended for future use for estimation of dynamic balance, while the test Standing on a bench in width (RASKS) has best metric characteristics and it is recommended for future use for evaluation of static balance in 7 year old children*.

Keywords: *metric characteristics, latent motor space, evaluation, norms, test used for estimation of balance, coefficients for reliability, satisfactory validity, dynamic balance, static balance*

INTRODUCTION

One of the main goals of the physical and health education, defined in the national curriculum for nine – year compulsory education in the Republic of Macedonia is development of motor abilities (Bureau for the development of education, 2007). Motor abilities are fundamental determinant of human motor space. Their development is based on human native characteristics and training (Kukolj, 2006) and it is highly related to the acquisition of different motor skills and habits (Matič, 1978). Different levels of development of motor abilities suggest different levels of motor efficiency and are related to development of human individual potentials (Jovanovski, (Јовановски), 2013). Considering the fact that motor abilities in children are manifested and developed differently, compared with adults (Jürimäe, T., & Jürimäe, J., 2001; Pišot & Planinšec, 2005, Bala & Katić, 2009), development, following and assessment of motor abilities in pre-school children and children in the early school period is one of the most important issues of research in kinesiology. This is especially important from the aspect of PE teaching process, sport training and selection of youth as well. From the aspect of PE teaching process, manifestation and assessment of motor abilities is especially important issue considering the fact that changes in motor abilities are one of the criteria for creation of final grade from the subject physical and health education, criteria for following and evaluation of individual development and improvement of every child, as well as a manner to determinate the efficiency of applied PE curriculum. In the process of sport training of youth, the level of basic motor abilities development should be one of the main objective criteria for selection of children in certain sport disciplines.

Balance is one of the abilities that defines human motor space. It is especially important in sports that are performed on reduced or unstable surface, such as beam exercises in gymnastics, ice skating, hockey, skiing, bicycling etc. In certain movements and sports, balance is very important in different phases of movement: when

maintaining certain position (example: gymnastics), during the movement (turns in gymnastics, dancing, ice skating etc), or at the end of the movement. Balance is defined as ability to undertake and maintain the necessary body position during a period of time (Jovanovski, (Јовановски), 2013). Zaciorski (1975), defines balance as ability to maintain a stable balanced position of the body when performing different movements and maintaining different positions.

Speaking about the latent structure of balance, authors mainly defined two types or factors of balance: *static balance* - when a body is not moving, or ability to maintain balanced position over a longer period of time and *dynamic balance* or ability to maintain balanced position of the body and changes of position during a number of repeated movements (*Age group development…*, 1999); Zaciorski, 1975; Gaić, 1985). In their studies, besides these two factors of balance, Kurelić, et al., (1975) have isolated yet another factor of balance named as a factor for balancing objects. In latent space, static balance is also defined as a balance with visual control (open eye balance) and balance without visual control (closed eye balanced movements) (Kurelić et al., 1975; Metikos, Prot, Hofman, Pintar, & Oreb, 1989).

From the aspect of structure of children`s motor space, depending on the applied model of research, the structural model (Metikoš et al, 1989) and the functional model, or model of hierarchic structure (Kurelić et al., 1975) the balance is isolated as independent factor or as a part of mechanisam for sinergethic regulation and regulation of muscule tonus. Regarded to this, in studies conducted with early school age children, as independent motor factor, balance, is isolated in studies conducted by Strel & Šturm, 1981; Perić, 1991; Rajtmajer, 1997; Sabo (Сабо) 2002; Pišot & Planinšec, 2005; Popeska, 2009; 2011. In these researches, balance is isolated as ability to maintain a complex motor structires in balance (Strel & Šturm, 1981), ability to maintain balanced positions or static balance (Pišot & Planinšec, 2005; Popeska, 2009; 2011). In studies where motor structure is defined with one general motor factor, balance is isolated as a part of the mechanisam for regulation of muscule tonus and sinergetic regulation (Rausavljević, 1992; Bala, Sabo & Popović, 2005; Toskić, Stanković, & Okićić, 2012; Zrnzević, Lilić, & Zrnzević, 2013). In all these studies conducted with 7 years old children, beside balance, the machanisam for regulation of muscule tonus and sinergetic regulation is also defined with the existance of flexibility. According to Pišot & Planinšec (2005) in a sense of development process, there is a tendency for maintaining and development of static balance at the beginning and fter that, in later stages of growth, development of dinamic balance. This could be explained with the function of proprioreceptors and the ability to process information form the enviornemnet and position of the body in space, responsible for standing in balanced position and maintaining balance. The physiological foundation of balance is in integration of many informations in one continuouse movement, which suggests on certain conection with the mechanisam of structure of movements, particularly with coordination (Planinsec & Pišot, 2005).

Previously mentioned notes, lead to determination of balance factors, manifestation and development. As a perfext example of perception and movement integration, balance is dependent on development of sense of vision, sense of hearing and proprioreceptors. Upon these, many researches examine the relation between manifestation and development of balance in children with hearing impaired, cerebral palsy, problems with sense of vision, children with Down sindrome (Uzun, 2013; Rajendran & Roy, 2011; Meneghetti, Blascovi – Assis, Deloroso, & Rodrigues, 2009).

Improvement of balance depends from the type of the task and in general it`s developing in the age period between 3 to 19 years. Upon the heredity of balance, its determined that balance is conditioned by the external environmental factors and the genetic code as well. It depends mostly on the efficient work of sthe small brain were the information from vestibular aperture are processed. The coefficient of heredity of balance, calculated in different tests is around 0.41 – 0.74 (Gajic, 1985). In the process of balance development, as children grow, they use more their kinesthetic information, regarded the visual information. Learning different movements, motor experiences allow children to redefine the motor control and maintain balance (Haywood & Getchel, 2004).

As regards the gender differences, as confirmed in many researches (Bala,1981; Perić,1991; Bala,1999, 2002; Bala & Nicin,1997; Pejćić & Malacko, 2005) there are no significant differences in manifestation of balance between males and females at the age of seven. Numerical differences but yet not statistical significant differences are obtained between gender in a sense of better test results in males (Zurc, Pišot & Strojnic, 2005). The authors Figura, Cama, Capranica, Guidetti & Pulejo (1991) noted more evident relationship between age and postural (static) balance, compared with gender. Improvement in static balance is noted in the 6 – 10 years range. Significant improvement of static balance is noted between the ages of 6 and 8, where between 8 and 10 the Improvement were smaller. This suggests that around 8 years of age some static balance abilities have already been acquired, such as two-feet postures, but somewhat more difficult postures, such as standing on one foot only, are still in their major developmental phases.

All previously mention notes about balance emphasize that motor abilities, including balance are in relation with certain period of age in childhood which is characterized with uncompleted development, uncompleted regulations of CNS, ongoing functional development, individual tempo of development, concerning different “biological time” in any individual. Therefore, findings about children’s` motor abilities in any age period, as well as specific manners of their manifestation and development and possibilities for their following and estimation, are the key issues for the PE teaching

process. Speaking about measurement and evaluation of motor ability in children, besides regular demands for standardization and good metric characteristics, motor tasks used in tests for estimation of children's motor abilities, should be conducted as a content of education curricula for certain age, or should be specially designed or modified for certain age group. According to the authors Ikeda & Aoyagi (2007) it is especially hard to select a motor test for children that will be sufficiently reliable, valid and practical because young children have not developed their sense for time and rivalry yet.

These issues were the basis for this paper, in aim to suggest motor tests with good metric characteristics used for estimation of balance at 7 year old children, to propose normative for evaluation of children's achievements and suggest contents for improvement of balance in 7 year old children. These normatives could be used as an objective manner for determination of children's achievements in order to follow their individual improvement, while suggested content could be used in order to contribute to the variety of PE classes.

METHODS

The research was realized on a sample of 123 examiners, 7 years old male children, pupils in second grade in five primary schools in Skopje, Republic of Macedonia. The examiners were tested in three motor tests hypothetically used for estimation of balance. Following tests were used: Walking on upturned Swedish bench (RAOSK), Standing on bench in width (RASKS) and Standing on bench in length (RASKD). The test Walking on upturned Swedish bench (RAOSK) was previously used with pre – school children in research of Perić (1991). Other two tests Standing on bench in width (RASKS) and Standing on bench in length (RASKD) were used and recommended by Bala (1981). All three tests were applied as two – item tests, realized with two repetitions. Considering the age and possibilities of examiners this number is accepted, needed and also recommended by other authors that realized researches with same age groups (Bala 1981, Pisot & Planinsec, 2005).

Tests characteristics: discrimination (sensitivity), asymmetric, homogeneity, reliability, validity and representatively are determined for all three applied tests. Discrimination, asymmetric and homogeneity were determined using measures for tendency and dispersion; reliability was estimated based of Crombah α and Spearman – Brown`s (SB) coefficients of reliability (coefficients higher than 0.80 are considered significant). Validity of motor tests is calculated using Pearson`s – coefficient of correlation (r), the value of characteristic roots, factor scores of projections of isolated factor and communalities using Hotelling procedures (values should be higher or equal at 0.80), while Kaiser-Meyer-Olkin`s measure is used for estimation of reliability and representativity (values should be higher or equal at 0.80), while Kaiser-Meyer-Olkin`s measure is used for estimation of reliability and representativeness (coefficient around .90 is excellent representativity, around.80 very good; around .70 good; .60 average; .50 the test have bad representativity and below.50 unacceptable). Normative for children's achievements in motor tests are defined using percentile classes and percentile values for 1, 3, 5, 10, 20, 25,30, 40, 50, 60, 70, 75, 80, 90, 95, 97 and 99 percentile. The results in final table for estimation of children`s motor achievements are obtained with reduction of percentile distribution in 5 percentile classes defined as: above 95 percentile –excellent achievement; from 75 to 95 percentile – achievement above average; from 26 to 75 percentile – average achievement; from 5 to 25 percentile – below average achievement and under 5 percentile – very bad achievement.

RESULTS AND DISCUSSION

Basic descriptive statistics parameters for all three tests applied for estimation of balance in 7 year old children are presented in Table 1. Obtained results for reliability, validity and representativeness for every certain test are presented in Tables 2, 3 and 4.

According to the results presented in Table 1, declination from normal distribution is noted in two out of three tests applied for estimation of balance: standing on a bench in width (RASKS) and standing on a bench in length (RASKD), or two tests that estimate static balance. Progressive improvement of average achievements from first to the second repetition is obtained for all three applied tests. This is also confirmed in study of tests characteristics including the balance test conducted by Bala (1999). This could be explained with better understanding of the task, acquisition of technique for

Table 1. Basic measures of central tendency, dispersion and normality of distribution of motor tests used for estimation of balance at 7 years old children (second grade)

Variables	Mean	SD	Sx	KV	MIN	MAX	Range	skew	Kurt	KS	p
RAOSK1	14,20	4,74	0,43	33,36	5,54	35,23	29,69	1,33	3,16	0,10	p > ,20
RAOSK2	13,43	4,83	0,44	35,96	5,4	33,26	27,86	1,47	2,97	0,12	p < ,10
RASKS1	5,98	5,53	0,50	92,39	0,81	34	33,19	2,12	5,63	0,21*	p < ,01
RASKS2	6,26	5,38	0,48	85,84	1	30,5	29,5	2,06	5,22	0,16*	p < ,01
RASKD1	11,14	10,08	0,91	90,50	1,11	45,9	44,79	1,35	1,16	0,19*	p < ,01
RASKD2	11,50	11,12	1,00	96,65	1,15	67,36	66,21	2,38	7,47	0,18*	p < ,01

realization and greater motivation of children for higher achievement. The same children were tested in same tests a year earlier in first grade (Popeska, 2014). Obtained results point out better average achievements in all three applied tests at the age of 7. These differences are statistically significant for the test walking on upturned Swedish bench (RAOSK) and only numerically better but statistically insignificant for the other two tests standing on a bench in width (RASKS) and standing on a bench in length (RASKD). Obtained results point out improvement of balance in children during one year period, while differences are explained with development changes characteristic for 6 and 7 year old children, manifested as different tempo of development and individual tempo of manifestation of certain development processes that influence to nearly the same achievement in the researched segment (Popeska, 2014). Values of the tests for discrimination (the relation of x and SD, 3:1) and asymmetry (skewness), suggest on tests with low discrimination which do not measure the differences in children's achievements and tests that are relatively hard to perform by these population of children. Authors Ikeda & Aoyagi (2007) in their study also noted that children have difficulties in performance of tests for stability and balance, or they are hard for them.

Table 2. Walking on upturned Swedish bench (RAOSK), reliability, validity and representativity obtained at 7 years old children

Item	r	SMC	H	h^2
1	.86	.74	.96	.90
2			.96	.90
Crobach′s α	SB	KMO	Lambda	%
.92	.93	.50	1.86	93.0

Table 3. Standing on bench in width (RASKS), reliability, validity and representativity obtained at 7 years old children

Item	r	SMC	H	h^2
1	.85	.72	.96	.93
2			.96	.93
Crobach′s α	SB	KMO	Lambda	%
.92	.92	.50	1.85	92.5

Results for reliability, validity and representativeness of every of applied tests for balance are presented in Tables 2, 3 and 4. Values of Spirman – Brown and Cranach's α coefficients of reliability (from .89 to .93) of all three movement tasks point out high reliability of all applied tests. Comparison of the three tests shows that the highest coefficient of reliability (.93) of SB is determined for the test Walking on upturned Swedish bench (RAOSK), while coefficients (.89) for both SB and Cronbach′s α are obtained for the test Standing on a bench in length (RASKD). Very high reliability of the tests suggests that other unsystematic factors such as emotional condition, concentration, attention etc have low influence on tests results and manifestation of balance in children. High reliability of test for balance of children is also confirmed by Bala (1999); Popeska & Jovanova (2014). Values for KMO index .50 for all three tests for balance suggest on bed representativeness of the tests.

Validity of applied tests is determined using factor analysis. Using Hotelling procedure of results from both repetitions in all four applied tests for balance, one significant root for every factor was isolated and it explains the variability of the applied systems with values from 90,41% to 93,02%. Highly explained variability points out that results obtained in both repetition on the same test are not significantly different which is confirmed with high projections of isolated factor for each test (.96 for RAOSK and RASKS and .95 for RASKD). The high factor validity obtained for applied tests for estimation of balance is also confirmed with significant coefficients of correlation between results of each repetition of every single test (from .81 to .96). High values of communalities from .90 to .93 of isolated factor of every single test confirm the homogeneity of obtained results. Good validity of test for estimation of balance is also confirmed in other studies conducted with children (Perić, 1991; Ikeda & Aoyagi, 2007, Popeska, 2014).

Analyzing the results for validity, reliability and representativeness of the tests for estimation of balance in 7 year old children, all three test have high validity and representativeness and low discrimination and representativeness. This means that all three test could be recommended for future use with 7 years old children. In situations of limited conditions for realization of measurement or in situation where short battery of tests is needed as a test with the best metric characteristics from these group of tests, we recommend the test Walking on upturned Swedish bench (RAOSK) for estimation of dynamic balance, or balance in movement and test Standing on bench in width (RASKS) for estimation of static balance.

In Table 5 are presented norms for children`s achievements in motor tests for estimation of balance. They are use with aim to follow the children`s individual improvements and their achievements in motor tests. They are divided in five percentile classes (excel-

Table 4. Standing on bench in length (RASKD), reliability, validity and representativity obtained at 7 years old children

Item	r	SMC	H	h^2
1	.81	.65	.95	.90
2			.95	.90
Crobach′s α	SB	KMO	Lambda	%
.89	.89	.50	1.81	90.4

Table 5. Norms for children`s achievements in tests for estimation of balance

	Norms	Walking on upturned Swedish bench (RAOSK)	Standing on bench in width (RASKS)
1	Very bad achievement	Above 23,85	Up to 1,19
2	Below average achievement	23,84 – 15,93	1,20 – 2,81
3	Average achievement	15,92 – 10,70	2,82 – 7,22
4	Achievement above average	10,69 – 7,87	7,23 – 16,06
5	Excellent achievement	Bellow 7,87	Above 16,07

lent achievement, achievement above average, average achievement, achievement below average and very bad achievement). Considering the fact that changes in motor abilities are one of the criteria for creation of final grade from the subject physical and health education, these norms applied for every motor ability, could be one of the criteria as well as an objective manner to follow and evaluate individual development and improvement of every child. Analyzing from the aspect of children, it could be a motvation factor for future individual improvement. Evaluation of childrens improvement in motor abilities could also be an efficient manner to determinate the efficiency of applied PE curriculum.

As prevoiusly mentioned, children possess balance as a motor ability that defines their motor space and contributes to their motor behaviour (Strel & Šturm, 1981; Perić, 1991; Rajtmajer, 1997; Sabo, 2002; Pišot & Planinšec, 2005; Popeska, 2009; 2011; Rausavljevic, 1992; Bala, et al., 2008; Toskić, et al., 2012; Zrnzević, et. al., 2013). Development of balance, development of perceptual abilities and function of vestibular aparature, maintainig balance when moving in certain positions are some of the aims defined in PE curriculum for second grade in the Republic of Macedonia. They are realized by practicing and perfoming different contents as a part of five compuliosory thematic units: *Body shaping, Basics of athletics*, *Basics of gymnastics* and *Games and* optional units: *activities in water, activities at snow, driving a bike, hiking, school sport and sports project*. Activities such as different types on walking and running on a beam, rope and other narrow surfaces, crawling on beam, balancing objects while moving, gymnastic elements on floor and beam, driving bicycles and rollers are already part of current PHE curriculum practiced in order to develop balance in children.

CONCLUSION

As a component part of abilities that define the human motor space, balance has an important role in PHE teaching process. All sports and activities that require establishment and maintain on certain position, or movement and realization of motor tasks on narrow and stable surface also require manifestation and development of balance. Relations between balance and other motor abilities, as well as the impact of regular physical activity on maintaining different types of balance are one of the main reasons why this motor ability should be improved and developed during the PE teaching process by using PE contents. In a sense of balance improvement in children, besides current PE contents conducted in PE curriculum for second grade, other activities could be implemented.

Different types of movement games that required maintaining of balance positions of hole body or certain body parts (for example: stone kids), activities such as pushing on beam or other narrow surface, walking and crossing in pairs on narrow surfaces, jumping and turning on trampoline, jumping and walking with tight legs, gymnastics routines on floor and beam appropriate for young children could be implemented in current PE curriculum. Furthermore, implementation of sports such as bycikling, roller, driving tricikles and bords, skatting, grass hockey, skiing, bording and other similar sport as a part of regular PE class in a segment of unions realized in cooperation with parents as well as a part of outdoor and extraculicular activities should be implemented and could enrich PHE curriculum in order to maintain and develop balance in young children. This is esspecialy important considering the fact that in the early school period, balance is still in developmental phase (Figura et al, 1991) and it`s development process should start as early as possible because it`s a sequential process conditioned by genetical components and enviormental impact as well. These components are also highly related with the phases of childrens development and its characteristics. Regarding to development characteristics manifestation and development of balance is also related with development of kinestetic system, sences, spatial orientation etc. Kinestetic system is related with information of positions of certain body parts as well as spatial orientation and these perception is creating diferently in children. At the age of 6, nearly 2/3 of kids

identify all body parts and these is related with maintaining balance positions. Spatial orientaion is highly related with sence of vision and a sensitive period for it`s development is the period between 6 and 8 years (Haywood & Getchel, 2004). From the other hand, this is related with balance as well. Integration of sence of vision and hearing is improved between 5 and 12 years, while visual – kinesthetic integration continuous to develop until the age of 11 (Haywood & Getchell, 2004). All these findings emphasize the importance of age period when consider the motor abilities and work with children.

Speaking about the evaluation and assessment of balance at 7 years old children, according obtained result, all three applied tests for balance in these research point out a good metric characteristics. Particularly, tests results suggest point out on high validity and representativeness and low discrimination and representativeness and could recommended for future use with 7 years old children. In situations of limited conditions for realization of measurement or in situation where short battery of tests is needed as a test with the best metric characteristics from these group of tests, we recommend the test Walking on upturned Swedish bench (RAOSK) for estimation of dynamic balance, or balance in movement and test Standing on bench in width (RASKS) for estimation of static balance. When testing children's ability, certain development characteristics should be also considered. In this since, we could talk about children emotional instability (*Age groupe development…,* 1999), their motivation and unpreparedness to activate their full potentials (Jürimae, T., & Jürimae, J., 2001), disorientation from the goal and understanding of testing as a game, which is especially noted in younger children. These and many other similar situations are the reason for many practical problems during the testing process with young children noted in this type of researches (Rajmajer, 1997; Pišot & Planinšec, 2005; Popeska, 2011). These findings allows certain activities, such as motivation, encouraging, demonstration and previous tries of the motor tasks, which are unacceptable in work with adults to be justified and recommended in work with children (Bala, 1999; Jürimae, T., & Jürimae, J., 2001). Therefore, in researches from this type as well as in everyday work with children, knowledge and appreciations of characteristics of children emotional and psychological development as well as their influence on children's motor abilities are essential. This means respect of holistic approach in work with children.

REFERENCES

Age group development program for mens & womens artistic gymnastics.(1999). Phase three, Federation Internationale De Gymnastique, FIG

Bala, G. (1981). *Struktura i razvoj morfoloških i motoričkih dimenzija dece SAP Vojvodine.* [Structure and development of morphologic and motor dimensions of children in Vojvodina. In Serbian.] Novi Sad: Fakultet fizićke kulture.

Bala, G. (1999). Some problems and suggestions in measuring motor behaviour of pre – school children. *Kinesiologija Slovenica*, *5*(1-2), 5 -10.

Bala, G. & Nićin. Dj. (1997). Motor behaviour of pre – school children under the influence of an unconventional sports educational model. In M. Pavlovič (Ed.), *Proceedings of the III International symposium Sport of the young*. Bled, Slovenia (64 - 69). Ljubljana: University of Ljubljana. Faculty of Šport.

Bala, G. (2002). Structuralne razlike motoričkih sposobnosti dećaka i devojćice u pretskolskom uzrastu. [Structural differences in motor abilities in pre – school boys and girls. In Serbian.] *Pedagoška Stvarnost, 48(*9-10), 744 -751.

Bala, G., Sabo, E., & Popović, B. (2005). Relationship between motor abilities and school readiness in preschool children. *Kinesiologija Slovenica, 11*(1), 5-12.

Bala, G., & Katič, R. (2009). Hypotetical model in testing integrated development of preschool children. *Collegium Antropologicum*, *33*(*2),* 353 -362.

Биро за развој на образованието. (2007). [Bureau for the development of education. In Macedonian.] Наставна програма по физичко и здравствено образование за девет-годишно основно образование. Скопје: Министерство за Образование на Република Македонија.

Figura, G. C., Capranica, L., Guidetti, L., & Pulejo, C. (1991). Assesment of static balance in children. *The Journal of Sport Medicine and Physical Fitness, 31*(2), 235 – 242.

Gajić, M. (1985). *Osnovi motorike coveka*. [Bases on human motoric. In Serbian.] Novi Sad: OOUR Institut fizicke kulture.

Haywood, K., & Getchell, N. (2004). *Life span motor development.* Champaign: IL. Human Kinetics.

Ikeda, T. & Aoyagi, O. (2007). Relationships between test characteristics and movement patterns, physical fitness, and measurement characteristics: suggestions for developing new test items for 2-6- year – old children. *Human Performance Measurement, 5*(1) 9 – 22.

Јовановски, Ј. (2013). *Антропомоторика.* [Anthropomotorics. In Macedonian.] Скопје: Универзитет „Св. Кирил и Методиј", Факултет за Физичка култура.

Jürimäe, T., & Jürimäe., J. (2001). *Growth, physical activity and motor development in prepubertal children*. New York: CRC Press.

Kukolj. M. (2006). *Antropomotorika*. [Anthropomotorics. In Serbian.] Beograd: Fakultet sporta i fizickog vospitanja.

Kurelić, N., Momirović, K., Stojanović, M., Sturm J., Radoević, H., & Viskić - Stalec, N. (1975). *Struktura i razvoj morfolockih i motorickih dimenzija omladine*. [Structure and development of morphologic and motor dimensions in youth. In Serbian.] Beograd: Institut za naucna istrazivanja Fakulteta za fizicko vaspitanje.

Matić, M. (1978). *Čas telesnog vezbanja.* [Physical education class. In Serbian.] Zrenjanin: Budučnost.

Meneghetti, CHZ., Blascovi – Assis, SM., Deloroso, FT., & Rodrigues, GM. (2009). Static balance ssessment among children and adolescents with Down syndrome. *Revista Brasileira de Fisioterapia*, *13(*3), 230 – 235.

Metikoš, D., Prot, F., Hofman, E., Pintar, Z., & Oreb, G. (1989). *Mjernje bazicnih motoricnih dimenzija sportasa*. [Measurement of basics motoric dimensions in athletes. In Croatian.] Zagreb: Komisija za udbenike i skripta, Fakultet za fizicku kulturu Sveucilista u Zagrebu.

Pejćić, A., & Malacko, J. (2005) The ontogenic development of morphological characteristics and motor abilities of boys and girls in early elementary school. *Kinesiologija Slovenica, 11*(2), 42 – 55.

Perić, D. (1991). *Komparativna analiza metodoloških sistema*

eksplikacije biomotoričkog statusa dece predškolskog uzrasta. [Comparative analyses of methodologic systems of biotical status of pre-school children. In Serbian.] (Unpulished doctoral disertstion, University of Belgarade) Beograd: Fakultet fizičke kulture, Univerziteta u Beogradu.

Pišot, R. & Planinšec, J. (2005). *Struktura motorike v zgodnjem otroštvu*. [The motor structure in children. In Slovenian.] Koper: Institut za kineziološke raziskave, Univerziteta in Primorskem.

Попеска, Б. (2009). *Утврдување и компарирање на латентната структура на моторичкиот простор кај ученици од машки пол на шест и седум годишна возраст*. [Determination and comparation on the latent structure of motor space in male six and seven years old children. In Macedonian.] (Unpublished Master's thesis, University in Skopje) Скопје: Факултет за физичка култура, Универзитет „Св. Кирил и Методиј".

Попеска, Б. (2011). *Развој на морфолошките и моторичките димензии кај деца од машки пол во возрасниот период од 6 и 7 години.* [Development of morphologic and motor dimensions in children in the age period of six and seven years. In Macedonian.] (Unpublished doctoral dissertation, University of Skopje). Скопје: Факултет за физичка култура, Универзитет „Св. Кирил и Методиј".

Popeska, B. (2014). Development changes in motor space in 6 and 7 years old children. *Research in Kinesiology*, *42*(2), 215-220.

Popeska, B., & Jovanova - Mitkovska, S. (2014). Draft battery of tests for evaluation of motor abilities in 6 years old children. *Research in Kinesiology*, *42*(1), 15-21.

Rival, C., Ceyte, H., & Olivier, I. (2005). Developmental changes in standing balance in children. *Neuroscience Letter, 376*(2), 133 – 136.

Rajtmajer, D., (1997). Comparative analysis of the structure of motor abilities of younger children. In M. Pavlovič (Ed.), *Proceedings of the III International symposium Sport of the young*. Bled, Slovenia (pp. 216 - 221). Ljubljana: University of Ljubljana. Faculty of Sport.

Rejendran, V., & Roy Finita, G. (2011). An overview of motor skill performance and balance in hearing impaired children. *Italian Journal of Pediatrics, 37*(1) doi:10.1186/1824-7288-37-33 Retrieved March 23, 2015 from: http://www.ijponline.net/content/37/1/33.

Rausavljević, N. (1992). *Relacije izmedju morfoloskih karakteristika i motorickih sposobnosti ućenika I ućenica prvih razreda osnovnih škola u Splitu.* [Relations between morphologic characteristics and motor abilities of male and female pupils in first grade in primary schools in Split. Doctoral disertation. In Croatian.] (Unpublished doctoral disertation, University of Skopje) Skopje: Fakultet za fizićka kultura.

Сабо, Е. (2002). Структура моторичког простора и разлике у моторичким способностима дечака предшколског узраста при упису у основну школу. [The structure of motor space and differences in motor abilities in boys when starting primary school. In Serbian.] *Физичка култура, 56*(1-4), 10 – 17.

Strel, J. and Šturm, J. (1981). *Zanesljivost in struktura nekaterih motoricnih sposobnosti in morfoloskih zancilnosti set in pol letnih ucencev in ucenk.*. [Dependence of structure of some motor abilities and morphological characteristics in six and a half years old pupils. In Slovenian.] Ljubljana: Fakulteta za telesno kulturo, Institut za kineziologijo.

Toskić, D., Stanković, V., & Okićić, T. (2012). A comparative analyses of the latent dimensions which occur as a result of variouse types of physical exercises. *Research in Kinesiology, 40*(2), 161-167.

Uzun, S. (2013). The effect of long-term training program on balance in children with cerebral palsy: Results of a pilot study for individually based functional exercises. *Educational Research and Reviews, 8*(11), 747-757, DOI: 10.5897/ERR2013.1454.

Zaciorski, M. (1975). *Fizićka svojstva sportista.* [Physical characteristics of athletes. In Serbian.] Beograd: NIP "Partizan".

Zrnzević, N., Lilić, Lj., & Zrnzević, J. (2013). Contribution of the experimental programme of physical education curriculum to the development of motor abilities. *Research in Kinesiology, 41*(2), 154-159.

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

Correspondence:
Biljana Popeska
Goce Delcev University in Stip
Faculty of Educational Sciences
Str. „Krste Misirkov" No.10-A , P.O 201, 2000 Štip, Macedonia
E-mail: Biljana.popeska@ugd.edu.mk