Original research article

POSTURAL DISORDERS IN PRESCHOOL CHILDREN IN RELATION TO GENDER

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Abstract. *If not detected and removed in time, poor posture in preschool and school children may cause extremely serious health problems in adulthood. The primary objective of this study is to define the postural status in the sagittal and frontal plane in preschool children in Belgrade. Secondary objectives are directed to determining the differences in the observed characteristicsof postural status in relation to the gender of the studied participants. In order to determine the postural status of the spine in the sagittal and frontal plane we used a 3D spine analyzer "Spinal Mouse". The sample consisted of 608 children aged 4 to 7, of which 419 were boys and 189 were girls. The results showed that poor posture is present in both genders in all monitored segments of the spine. At the level of the entire sample of participants, the most common is poor posture in the lumbar region of the spine in the sagittal plane in boys (32.46%) and in the thoracic region in girls (30.15%). Poor posture is more frequent in the sagittal than in the frontal plane. Statistically significant differences were found in relation to gender (Wilks' Lambda 0.905, F=10.278, p=0.000). Physical activity, specially programmed and planned exercises aimed at contributing togood posture, should and must be represented as an important means of prevention in the daily activities of children.*

Key words: *poor posture, kyphosis, lordosis, scoliosis, preschoolers*

INTRODUCTION

Proper posture is increasingly less present in the every day life of children. If it occurs in early childhood, the pattern of good posture and habits of regular participation in

various forms of physical activity contributes not only to proper growth and development of children but is later positively reflected on their health and culture of living (Protić – Gava & Krnjeta, 2010). Preschool children, unlike other children, are still in the process of forming healthy habits that will continue to reflect on their future quality of life. If not detected and removed in time, poor posture in preschool and school children may cause extremely serious health problems in adulthood. Systematic monitoring and assessment of thepostural status of children can detect many health problems in time - before they become serious. Due to the sensitivity of a child's body, forming proper postural status is essential, both in the preschool period and in the first years of schooling (Sabo, 2006).

The impact of growth and development on the postural status of preschool children is a particularly interesting area of research, especially when one knows that it occurs in the sensitive period of growth and development, and therefore there is an increased level of possibility of structural damage to the locomotive apparatus due to sudden changes in skeletal development which are most often manifested primarily in the form of functional postural disorders (Živković, 2000; McEvoy & Grimmer, 2005; Demeši, 2007; Bogdanović & Milenković, 2008; Beganović & Bešović, 2012). For this reason, permanent research attempts to assist in the implementation of preventive action on the postural status of preschool children in practice, pointing out some rules, the inevitability of the development process, all with the aim of proper guidance and planning of physical exercise in the framework of programmed activities in working with preschool children. Changes in terms of deviations from normal postural status are common in the period of growth and development (child and adolescent period). According to McEvoy & Grimmer (2005), postural control develops segmentarily in the cephalocaudal direction. It begins by establishing head control, followed by trunkcontrol only to finally achieve postural stability when standing. The motor and sensor system which is responsible for postural stability goes through a transition at the age of four to six, reaching the maturity of an adult between the ages of seven to ten. The evolution of posture in the sagittal plane occurs between the age of four and twelve and is considered a consequence of normal of musculoskeletal maturation, or the result of the adaptation process in terms of maintaining balance in the sagittal plane (Lafond, Descarreaux, Normand, & Harrison, 2007). Postural disorders are more common in childhood and adolescence. In the preschool and early school age, functional disorders of posture are the most common, while the adolescent age is characterized by the occurrence of the structural deformities of the spine (Živković, 2000; Demeši, 2007; Bogdanović, 2008; Bogdanović & Milenković, 2008; Beganović & Bešović, 2012). The posture of boys and girls in the preschool and lower primary school period is characterized by head protrusion, bent shoulders, winged scapula, anterior pelvic tilt, which is often accompanied by pronounced lumbar lordosis and abdomen protrusion (Penha, Joao, Casarotto, Amino & Penteado, 2005). Given the fact that the attention of experts and scientists is increasingly occupied by children obesity, poor posture and lack of physical activity, there is an intense need for monitoring obesity and improving postural status in children (Burdyukova, Pustovalov, Oranskaya, Pertsov, & Gurevich, 2012). Therefore, identifying, defining and monitoring postural status is of the utmost importance for lifelong normal body functioning, as well as for the establishment of predispositions for the good health of an individual.

Precisely because of the above, the primary goal of this research is to define postural status in the sagittal and frontal plane in preschool children in Belgrade. Secondary objectives are aimed at determining the existence of differences in theobserved characteristic of postural status in relation to the gender of the studied participants.

<center>METHODS</center>

Participants

The sample consisted of 608 children aged 4 to 7, of which 419 were boys and 189 were girls. All of the participants were members of the children's sports school in the city of Belgrade.

Measuring instruments

In order to evaluate the state of the postural status of the spinal column in the sagittal and frontal plane, we used the "Spinal Mouse" (IDIAG, Fehraltdorf, Switzerland, www.idiag.ch) measuring instrument, a non-invasive method of measuring postural status, along with the appropriate software. The validity and reliability of this instrument was evaluated in the research of Malavolti et al., 2003; Kiss, 2008; Bedogni et al., 2013; Bosaeus,Wilcox, Rothenberg, & Strauss, 2014; Topalidou, Tzagarakis, Souvatzis, Kontakis, & Katonis, 2014. This method of determining the state of the postural status of the spinal column was already used in studies carried out on the population of preschool and school age children (Bubanj et al., 2010; Bubanj et al., 2012; Milenkovic et al., 2011; Jorgić et al., 2015).

The sample of variables

Based on a different classification obtained from the available literature (Živković & Milenković, 1995; Živković, 2000; Đorđić, 2007) to assess the characteristics of postural status we used the following variables:

Measurement in the sagittal plane

- The degree of the curvein the thoracic region of the spinal column - Thoracic spine, expressed in degrees
  - Reduced value of the curve (< 20 degrees) – TSHipo
  - Increased value of the curve (>40 degrees) – TSHiper
  - Normal value of the curve (from 20 to 40 degrees) – TSNormal
- The degree of the curve in the lumbar region of the spine - Lumbar spine, expressed in degrees
  - Reduced value of the curve (< 20 degrees) – LSHipo
  - Increased value of the curve (>40 degrees) – LSHiper
  - Normal value of the curve (from 20 to 40 degrees) – LSNormal
- The inclination of the spinal column - Incl., expressed in degrees
  - Normal value (from 0 to 5 degrees) – IncNormal
  - Increased value (from 5 to 10 degrees) – IncOver
  - Markedly increased value (>10 degrees) – IncHiper

Measurement in the frontal plane

- The degree of the curvein the thoracic part of the spinal column - Thoracic spine, expressed in degrees
  - Normal value of the curve (from 0 to 10 degrees) – TSNormal
  - Scoliotic posture (from 10 to 20 degrees) – TSScolP

- Scoliosis (> 20 degrees) TSScol
▪ The degree of the curve in the lumbar region of the spinal column - Lumbar spine, expressed in degrees
  - Normal value of the curve (from 0 to 10 degrees) – LSNormal
  - Scoliotic posture (from 10 to 20 degrees) – LSScolP
  - Scoliosis (> 20 degrees) – LSScol
▪ The inclination of the spinal column - Incl., expressed in degrees
  - Normal value (from 0 to 5 degrees) – IncNormal
  - Increased value (from 5 to 10 degrees) – IncOver
  - Markedly increased value (>10 degrees) – IncHiper

Data processing

In the data processing, basic descriptive statistics were used that establish the measures of central tendency (mean) and of variability (standard deviation, range, maximum and minimum scores). In order to determine the differences in arithmetic means according to gender, the Multivariate statistical analysis (MANOVA method) was used. All statistical methods were implemented using software package SPSS for Windows Release 20.0 (Copyright ©SPSS Inc., 1989-2011).

RESULTS

The results of descriptive statistics are shown in Table 1 (the values of measurement in the sagittal plane) and Table 2 (the results of measurement in the frontal plane).

Table 1 The results of the descriptive statistics for the sagittal plane measurements

Sagittal plane	Male	Female
Thoracic spineMean±SD	33.78±9.11	32±8.9
Thoracic spineCv%	26.96	27.8
Thoracic spine Min-Max	3-59	4-53
Normal value of the thoracic curve (aps/%)	290/69.21	132/69.84
Reduced value of the thoracic curve (aps/%)	21/5.01	17/8.99
Increased value of the thoracic curve (aps/%)	108/25.78	40/21.16
Lumbar spineMean±SD	24.3±8.39	28.94±7.91
Lumbar spineCv%	34.51	27.31
Lumbar spine Min-Max	1-49	11-51
Normal value of the lumbar curve (aps/%)	283/67.54	155/82.01
Reduced value of the lumbar curve (aps/%)	120/28.64	21/11.11
Increased value of the lumbar curve (aps/%)	16/3.82	13/6.88
Inclination Mean±SD	2.63±2.15	2.41±2.03
Inclination Cv%	81.69	84.09
Inclination Min-Max	0-11	0-9
Normal value of the inclination (aps/%)	349/83.29	161/85.19
Increased value of the inclination (aps/%)	67/15.99	28/14.81
Markedly increased value of the inclination (aps//%)	3/0.72	0/0

Mean ± SD - mean value and standard deviation, cV% - coefficient of variation,
Min-Max - minimum and maximum values, aps/% - absolute / percentage value.

Table 2 The results of the descriptive statistics for the frontal plane measurements

Frontal plane	Male	Female
Thoracic spineMean±SD	3.76±2.72	3.61±2.68
Thoracic spinecV%	72.35	74.15
Thoracic spine Min-Max	0-15	0-14
Normal value of the thoracic curve (aps/%)	420/97	186/97.38
Scoliotic posture in the thoracic region (aps/%)	13/3	5/2.62
Scoliosis in the thoracic region (aps/%)	0/0	0/0
Lumbar spineMean±SD	4.62±2.72	5.61±3.08
Lumbar spineCv%	58.81	54.91
Lumbar spine Min-Max	0-15	0-16
Normal value of the lumbar curve (aps/%)	411/94.92	173/90.58
Scoliotic posture in the lumbar region (aps/%)	22/5.08	18/9.42
Scoliosis in the lumbar region (aps/%)	0/0	0/0
Inclination Mean±SD	1.71±1.33	1.58±1.26
Inclination Cv%	77.68	79.82
Inclination Min-Max	0-6	0-5
Normal value of the inclination (aps/%)	418/96.54	185/96.86
Increased value of the inclination (aps/%)	15/3.46	6/3.14
Markedly increased value of the inclination (aps/%)	0/0	0/0

Mean ± SD - mean value and standard deviation, cV% - coefficient of variation,
Min-Max - minimum and maximum values, aps/% - absolute / percentage value.

The multivariate statistical analysis found that between the studied subsamples there is a statistically significant difference of all examined characteristics of the postural status: in males at the level of Wilks' Lambda 0.900, F=2.398, p=0.001, in females at the level of Wilks' Lambda 0791, F = 2.403, p = 0.001, and between the genders at the level Wilks' Lambda 0.905, F = 10.278, p = 0.000 (the results are shown in Table 3).

Table 3 Results of the multivariate analysis on a general level

Multivariate Tests	Effect	Value	F	Hypothesis df	Error df	Sig.
Male	Wilks' Lambda	.900	2.398	18.000	1134.685	.001
Female	Wilks' Lambda	.791	2.403	18.000	501.117	.001
Between gender	Wilks' Lambda	.905	10.278	6.000	589.000	.000

Also, it was found that there are statistically significant differences for the following examined subregions compared to the observed subsamples with respect to gender (the results are shown in Table 4).

Table 4 The differences in the studied characteristics of the postural status in relation to gender

Tests of Between-Subjects Effects	Source	Type III Sum of Squares	df	Mean Square	F	Sig.
	Thoracic curve in the sagittal plane	448.291	1	448.291	5.374	.021
Gender	Lumbar curve in the sagittal plane	2701.099	1	2701.099	39.550	.000
	Lumbar curve in the frontal plane	137.807	1	137.807	17.026	.000

DISCUSSION

Observed in the sagittal plane, the results of the research showed that poor posture is present in both boys and girls in all monitored segments of the spinal column (Figure 1, Table 1, 3, 4). The results showed that, at the level of the whole sample of participants, the most common poor posture is in the lumbar region of the spine in boys (32.46%) as opposed tothe thoracic region in girls (30.15%). Based on the results, it can be concluded that poor posture is more common in boys than in girls (Figure 1, Table 1, 3,4).
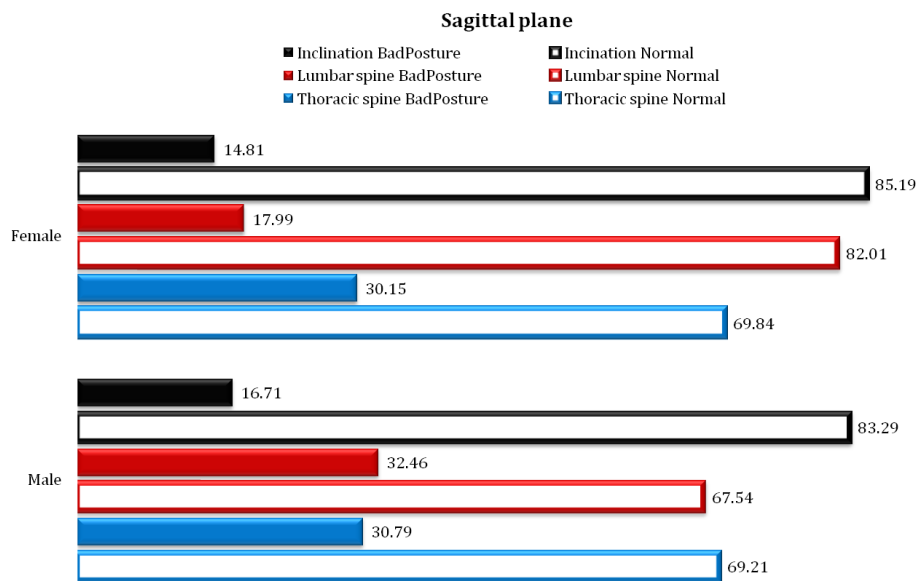
Sagittal plane

- ■ Inclination BadPosture
- □ Incination Normal
- ■ Lumbar spine BadPosture
- □ Lumbar spine Normal
- ■ Thoracic spine BadPosture
- □ Thoracic spine Normal

Female
- 14.81
- 85.19
- 17.99
- 82.01
- 30.15
- 69.84

Male
- 16.71
- 83.29
- 32.46
- 67.54
- 30.79
- 69.21

Fig. 1 The incidence of poor posture in the sagittal plane (% value)

As opposed to the results obtained by measuring in the sagittal plane, in the frontal plane, the results of the research showed that poor posture is less present in boys and girls in all monitored segments of the spinal column (Figure 2, Table 2, 3, 4). The results showed that, at the level of the whole sample of participants, the most common poor posture occurs in the lumbar region of the spine in both boys (5.08%) and girls (9.42%). Unlike measurements in the sagittal plane, based on the results it can be concluded that poor posture in the frontal plane is more common in girls than boys (Figure 2, Table 2, 3, 4).

Research on physical deformities in children of a preschool age has not often been the subject of interest of researchers, thus a more comprehensive comparative analysis of the results of this research is limited. The results of the available studies are somewhat different, although still largely similar. The research results of Živković & Milenković (1995) obtained for a sample of children who attended kindergarten in the municipality of Niš show that there are incipient forms of deformity on: the spine in 52%, chest in 24%, feet in 61% and that there is observed obesity in 61%, and malnutrition in 9% of the children. Research (Tot, 2001; Sabo, 2003) on thepostural status of preschool children in Novi Sad shows that there are minor deviations in the posture of the head in 27.9%, shoulders in 51.8%, scapulae in 45.6%, abdomen in 54.3%, legs in 24.9% and feet in 39.8%

of the children. The boys had better posture of the head and abdomen and the girls better foot instep.
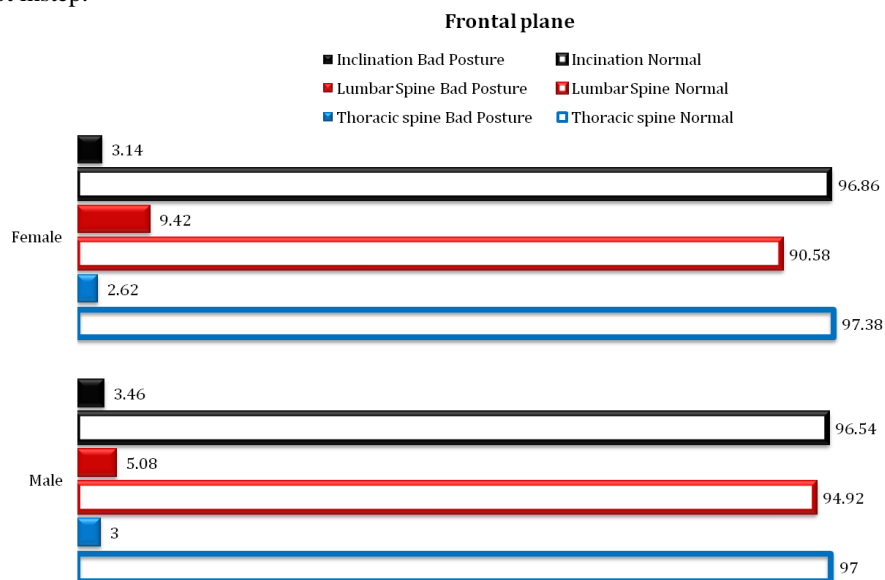
Frontal plane

■ Inclination Bad Posture □ Incination Normal
■ Lumbar Spine Bad Posture □ Lumbar Spine Normal
■ Thoracic spine Bad Posture □ Thoracic spine Normal

Female
3.14
96.86
9.42
90.58
2.62
97.38

Male
3.46
96.54
5.08
94.92
3
97

Fig. 2 The incidence of poor posture in the frontal plane (% value)

The research of Jorgić et al. (2015) shows that in the preschool age and young school age groups, there is more than 50% or more precisely 52.2% of children with a postural disorder of the spinal column in the sagittal plane. Postural disorders of the sagittal plane were also determined for children of a preschool age in the study of Romanov, Stupar, Međedović, & Brkin (2014), in as many as 45.86% of the children. Unlike in the current study, Simov, Minić, & Stojanović (2011) determined, based on their analysis of a sample of 968 preschool children, that only 10.3% of the children had postural disorders. In the case of distribution in relation to gender, among the boys, there was evidence of a greater frequency of lordotic posture, while among the girls kyphotic posture was more pronounced. These results partly match those of Romanov et al. (2014). These authors also determined more extensive lordotic postures among boys.

As can be concluded from the above research, the results show that in the preschool age there is an increasing number of children with poor postural status. All these pathological changes have a negative impact on the whole body, which requires finding adequate solutions. The current situation is worrying, but with a lot of conscientious work, the final outcome can be positive. The research of Stanković & Zdravković (2005) (In: Pavlović, 2012), which was conducted in the Municipality of Negotin on a sample of 543 children, prior to their enrolling school, indicated that daily physical exercise can help prevent the occurrence of physical deformities. The study of Madić (2006) analyzed the postural status in 1347 children aged 4 to 7 from all over Vojvodina. The results unambiguously showed that children with better motor skills did not have, or had far less pronounced postural disorders of the body. Good postural position is not as prominent in children's daily activities. Improper sitting, standing, various forms of motion activities, as

well as certain endogenous factors systematically affect the spinal column, limbs, feet, causing changes which often exceed the tolerance zone of soft tissue, not incurring major damage, but by cumulative operation through repetitive and long-term positions and movements, tissues experiencecertain deformations in terms of their morphology and function. This leads to shortening or weakening of certain muscles which consequently leads to muscle imbalance, which represents the major cause for the occurrence and development of poor posture, postural disorders and in extreme cases, physical deformities. Many studies of thepostural status of children and youth report that there are more and more people who have poor posture, or some physical deformity. The critical period for the development of poor posture and physical deformities is the period of erection, the periodof starting school, as well as the period of puberty (McEvoy & Grimmer, 2005; Penha, Joao, Casarotto, Amino, & Penteado, 2005). Therefore, one must start with prevention at an early age, starting from the preschool age throughout schooling. Of course, during the preschool age, the emphasis is primarily on the preparation of the muscles that will be particularly engaged in proper seating at school, as well as the muscles that provide a normal foot arch. To prepare for the critical periods in the development of poor posture, we must begin with these activities as early as in the preschool age, in the form of preventive treatment which contributes to further strengthening of the muscles that ensuregood posture. This is particularly important for it is followed by the next critical period for the development of poor posture and physical deformities - the period of puberty. The most important role in forming and maintaining good posture is played by the muscles, as an active part of the apparatus for movement. The weakness of certain muscle groups, and their excessive and one-sided load can cause a variety of disorders of the spine, upper and lower limbs.

CONCLUSION

Based on the obtained results, we can conclude that poor posture is present in both genders in all monitored segments of the spinal column. At the level of the entire sample of participants, the most common are poor posture in the lumbar region of the spine in the sagittal plane in boys (32.46%) and in thethorasic region in girls (30.15%). Poor posture is more common in the sagittal than in the frontal plane. Statistically significant differences were found with regard to gender (Wilks' Lambda 0.905, F = 10.278, p = 0.000). The increase in the representation of poor posture as early as in the preschool population deserves due consideration, whereby it is, as always, better to prevent it in this period than totreat in the older age categories. By regular identifying, defining and monitoring of postural status, we can prevent later problems. Given that poor posture is the first phase of the development of physical deformities, using corrective gymnastics, as a special form of kinesitherapy or treatment with movement, it is possible to achieve positive effects in poor posture rehabilitation. Physical activity, specially programmed and planned exercises aimed at contributing to good posture, should and must be represented as an important means of prevention in the daily activities of children.

LIMITATION OF STUDY AND FUTURE RESEARCH

For the generalization of data obtained in the general population, it is necessary to carry out extensive research as soon as possible, which will include the examination of

bad posture in relation to the age groups of preschool children. Subsequent studies should include and examine the influence of special programmed physical activity on postural status of preschool children.

REFERENCES

Bedogni, G., Agosti, F., De Col, A., Marazzi, N., Tagliaferri, A., & Sartorio, A. (2013). Comparison of Dual-energy X-ray Absorptiometry, air displacement plethysmography and bioelectrical impedance analysis for the assessment of body composition in morbidly obese women. *European Journal of Clinical Nutrition*, 67 (11), 1129-1132.

Beganović, E., & Bešović, M. (2012). Analysis of body posture of younger pupils in the area of the city of Sarajevo. *Sportski Logos*, 10 (19), 25-33.

Bogdanović, Z., & Milenković, S. (2008). Morphological space and postural disorders in young school age children. *Journal of Anthropological Society of Serbia*, 43, 371-378.

Bosaeus, I., Wilcox, G., Rothenberg, E.,& Strauss, B. (2014). Skeletal muscle mass in elderly hospitalized patients: Comparison of measurements by single-frequency BIA and DXA. *Clinical Nutrition*, 33, 426-31.

Bubanj, S., Milenković, S., Stanković, R., Bubanj, R., Živković, M., Atanasković, A., & Gašić, T. (2010). The correlation between explosive strength and sagittal postural status. *Facta Universitatis Series: Physical Education and Sport*, 8 (2), 173-181.

Bubanj, S., Živković, M., Živković, D., Milenković, S., Bubanj, R., Stanković, R., Ćirić-Mladenović, I., Stefanović, N., Purenović, T., Stojiljković, D., Obradović, B., Dimić, A., & Cvetković, T. (2012). The incidence of sagittal postural deformities among high school students: Preliminary study. *Acta Kinesiologica*, 6 (2), 27-30.

Burdyukova, E.V., Pustovalov, D.A., Oranskaya, A.N., Pertsov, S.S., & Gurevich, G.K. (2012). Mechanisms of maladaptation to physical exercise in moscow schoolchildren. *Bulletin of Experimental Biology and Medicine*, 153 (4), 428-430.

Demeši, T. (2007). *Anti-gravity muscles and postural status of children aged 7 and 13.* Unpublished Master's thesis, Novi Sad: Faculty of Medicine. In Serbian

Đorđić, V. (2007). *Posturalni status predškolske dece (Postural status of preschool children).* In: G. Bala (Ed.), Anthropological characteristics and abilities of preschool children, Book of Proceedings, pp.153-202, Novi Sad: Faculty of Sport and Physical Education. In Serbian

Jorgić, B., Milenkovic, M., Ždrale, S., Milenković, S., Stanković, R., & Bubanj, S. (2015). Spinal cord posture in the sagittal plane among young schoolchildren residing in the area of Knjaževac. *Facta Universitatis Series: Physical Education and Sport*, 13 (2), 311-318.

Kiss, R.M. (2008). Verification of determining the curvatures and range of motion of the spine by electromechanical - based skin - surface device. *Periodica Polytechnic*, 52 (1), 3-13.

Lafond, D., Descarreaux, M., Normand, M.C., & Harrison, D.E. (2007). Postural development in school children: a cross-sectional study. *Chiropractic & Osteopathy*, 4, 15-21.

Madić, D. (2006). Relations between motor and postural status in preschool children in Vojvodina. In: G. Bala (Ed.), Interdisciplinary scientific conference with international participation "Anthropological Status and Physical Activity of Children and Youth", Book of Proceedings (pp.185-191). Novi Sad: Faculty of Sport and Physical Education.

Malavolti, M., Musso, C., Poli, M., Fantuzzi, A., Salvioli, G., Battistini, N., & Bedogni, G. (2000). Cross-calibration of Eight-polar Bioelectrical Impedance Analysis versus Dual-energy X-ray Absorptiometry for the assessment of total and appendicular body composition in healthy subjects aged 21-82 years. *Annals of Human Biology*, 3 (4), 380-391.

Mc Evoy, M.P., & Grimmer, K. (2005). Reliability of upright posture measurements in primary school children. *BioMed Central Series: Musculosceletal Disorders*, 29 (6), 35.

Milenković, S., Bubanj S., Živković, M. Živković, D., Stanković, R. Bubanj, R., Purenović, T., Stojiljković, D., Obradović, B., Dimić, A., & Cvetković, T. (2011). The incidence of scoliotic bad posture among high school students: Preliminary study. *Facta Universitatis Series: Physical Education and Sport*, 9(4), 365-373.

Pavlović, S. (2012). Prisustvo telesnih deformiteta dece predškolskog uzrasta (Presence of body deformities at preschoolers). Univerzitetska misao, 11, 6-14. In Serbian

Penha, P.J., Joao, S.M., Casarotto, R.A., Amino, C.J., & Penteado D.C. (2005). Postural assessment of girls between 7 and 10 years of age. *Clinics*, 60 (1), 9-16.

Protic - Gava, B., & Krnjeta, Ž. (2010). Postural status of children of early school age in four Districts of Vojvodina. *Journal of Anthropological Society of Serbia*, 45, 375-383.

Romanov, R., Stupar, D., Međedović, B., & Brkin, D. (2014). The postural status of preschool age children on the territory of Novi Sad. *TIMS Acta*, 8, 129-135.

Sabo, E. (2006). Postural status of preschool children in the territory of AP Vojvodina. *Physical Education*, 60 (2), 157-164.

Simov, S., Minić, S., & Stojanović, D. (2011) Učestalost pojave lošeg držanja tela i ravnih stopala kod dece predškolskog uzrasta (The frequency of bad posture and flat feet in preschool children). *Apollinem Medicum et Aesculapium*, 9(2), 5-8. In Serbian

Topalidou, A., Tzagarakis, G., Souvatzis, X., Kontakis, G., & Katonis, P. (2014). Evaluation of the reliability of a new non-invasive method for assessing the functionality and mobility of the spine. *Acta of Bioengineering and Biomechanics*, 16 (1), 117-124.

Tot, J. (2001). *Posturalni status dece predškolskog uzrasta u Novom Sadu (Postural status of preschool children in Novi Sad)*. Unpublished Graduate work, Novi Sad: Faculty of Physical Education. In Serbian

Živković, D., & Milenković, S. (1995). Condition of postural disorder in preschool children. *Physical Culture*, 40, 2-13.

Živković, D. (2000). *Teorija i metodika korektivne gimnastike* (*Theory and Methodology of Corrective Gymnastics*. Niš: Grafika Galeb. In Serbian

LOŠE DRŽANJE TELA DECE PREDŠKOLSKOG UZRASTA U ODNOSU NA POL

Ukoliko se ne uoči i otkoni na vreme loše držanje tela predškolske i školske dece može prouzrokovati veoma ozbiljne zdravstvene probleme u odraslom životnom dobu. Primarni cilj ovog istraživanja je definisanje posturalnog statusa u sagitalnoj i frontalnoj ravni kod dece predškolskog uzrasta na teritoriji Beograda. Sekundarni ciljevi su usmereni na utvrđivanje postojanja razlika posmatranih karakteristika posturalnog statusa u odnosu na pol. Za utvrđivanje posturalnog statusa kičmenog stuba u sagitalnoj i frontalnoj ravni korišćen je merni instrument „Spinal Mouse“. Uzorak je činilo ukupno 608 dece uzrasta od 4 do 7 godina, od čega 419 dečaka i 189 devojčica. Rezultati su pokazali da je loše držanje tela prisutno kod oba pola u svim uzrasnim kategorijama i u svim praćenim segmentima kičmenog stuba. Na nivou celog uzorka ispitanika, najučestalije je loše držanje u lumbalnom delu kičmenog stuba u sagitalnoj ravni kod dečaka (32.46 %) a kod devojčica u tokaralnom delu (30.15%). Loše držanje tela učestalije je u sagitalnoj nego u frontalnoj ravni. Statistički značajne razlike utvrđene su u odnosu na pol (Wilks' Lambda 0.905, F=10.278, p=0.000). Fizička aktivnost, posebno programirano i plansko vežbanje usmereno da deluje na pravilnu posturu, treba i mora da bude zastupljeno kao važno sredstvo prevencije u svakodnevnim aktivnostima dece.

Ključne reči: *loše držanje, kifoza, lordoza, skolioza, predškolski uzrast*