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Research article

BODY HEIGHT AND LORDOTIC POSTURE IN PRESCHOOL CHILDREN

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Abstract. *The aim of this research is to determine the relation between body height and lordotic posture in preschool children. The survey was conducted on a sample of 149 participants (78 boys and 71 girls), aged 6 years (± 6 months), of an average body height (BH) of 121.94±10.29 cm, and the body mass 23.20±4.83kg in the city of Kragujevac (Serbia). To assess lordotic posture, the Spinal Mouse was used, and all values above 30˚ were treated as disorders in the lumbar region. In determining the size of the body, the Anthropometer by Martin is used, and the participants were divided into five groups by height. The existence and size of the correlation between the investigated areas was calculated by the use of the Pearson's chi-squared test and contingency coefficient as a measure of correlation. From the total sample, lortodic posture is present in 8.05 % of the participants, and in terms of gender the incidence of poor posture is equal. Lordotic posture is most pronounced in the group of boys and girls with the BH of 123.01-127.00 cm, followed by the group of girls with a BH of 121.51-123.00 cm. The lowest incidence of lordotic posture is determined in the groups with BH over 127.01 cm, and below 119 cm. The values of the Pearson's chi-squared test indicate a statistically significant correlation between lordotic posture and body height, with a significance 0.03.*

Key words: *Body Height, Lordotic Poor Posture, Incidence, Correlation, Preschool Children*

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INTRODUCTION

Lumbar lordosis refers to an adaptation that ensures stability in humans when standing and walking (Wren et al., 2017). The habit of paying attention to whether children adopt correct body position in everyday life is lacking (Kot, Kokosz, & Stencel-Gabriel, 2018), and as a consequence there is an increased incidence in lower back pain (Sadler, Spink, Ho, De Jonge, & Chuter, 2017), and sleeping disorders (Lauridsen & Hestbaek, 2013). By correcting the position of the body and placing the lumbar part in a neutral position, back pain can be reduced (Smith, O'Sullivan, & Straker, 2008). Hence, poor postural status represents a growing, but still underestimated health problem that needs preventive and accurate diagnosis (Jorgić et al., 2016).

In lumbar lordosis the aligned position of the pelvis is compromised by the unequal contracting forces of the abdominal and hamstring muscles that should normally be in balance with each other (Jang, Koh, & Han, 2013). Physical factors with the highest odds for lower back pain are a higher lumbar lordotic apex and an increased pelvis retroversion (Dolphens et al., 2016). According to Mulhearn & George (1999) lumbar hyperlordosis is associated with the dysfunction of the transversus abdominis muscle. According to Malai, Pichaiyongwongdee, & Sakulsriprasert (2015), hold-relax stretching of the iliopsoas muscle can be beneficial in reducing pain intensity, lumbar hyperlordosis and in improving the function of the transversus abdominis muscle in patients with excessive lumbar lordosis.

The sedentary lifestyle of today's adolescents consisting of a low level of physical activity, and a high level of computer oriented mental activities has reached epidemic proportions. Computer technology offers the young population a lot of entertainment and information resources, so that they spend more time in the so-called passive positions (sitting and lying). Such habits are distancing them from the natural need for movement and significantly reduce most of their physical and functional abilities. In a word, the children of today are playing in the fresh air less and are less physically active.

In terms of the above-mentioned the aim of this research is to determine the relation between body height and lordotic posture in preschool children.

METHODS

The research was conducted on a sample of 149 pre-schools children (78 boys and 71 girls), aged 6 years (±6 months) of the city of Kragujevac (Serbia), with an average body height of 121.94±10.29 cm (Mean±SD), and an average mass of 23.20±4.83 kg (Mean±SD). For the assessment of lordotic posture, non-invasive measurement methodology provided by the Spinal Mouse device was used (Idiag, Fehraltdorf, Switzerland, www.idiag.ch). The validity and reliability of the Spinal Mouse device are confirmed in previous studies (Mannion, Knecht, Balaban, Dvorak, & Grob, 2004; Post & Leferink, 2004; Forster, 2006; Guermazi et al., 2006).

Lumbar angulation in the sagittal plane was evaluated in a standing position. In order to classify the level of the disorder by category, the values determined by Cobb were used. Angulation of 15-30˚ is considered normal, and all values above 30˚ are treated as disorders in the lumbar region.

Body height is determined according to the methodology recommended by the International Biological Program (Weiner & Lourie, 1969), and with usage of the Anthropometer by Martin.

Children were divided into the following five groups according to body height (BH): 1) less than 119.00 cm; 2) between 119.01-121.50 cm; 3) between 121.51-123.00 cm; 4) between 123.01-127.00 cm, and 5) more than 127.01 cm.

Standard descriptive parameters (mean, minimum score, maximum score, standard deviation) were used. Pearson's chi-squared test (H^2) with a significance level of the correlation set at $p \leq 0.05$ was calculated by using the statistical package for data analysis SPSS, version 12.

RESULTS

Descriptive parameters of the postural status in relation to gender, as well as values of Pearson's chi-squared test, the contingency coefficient and the significance are presented in Table 1.

Table 1 Lordotic posture in relation to gender

Postural status		Gender		Total
		Boys	Girls	
Good posture	Count	72	65	137
	%	92.31	91.55	
	% of Total	48.32	43.62	91.95
Lordotic posture (the deviation is larger than 30°)	Count	4	6	10
	%	5.13	8.45	
	% of Total	2.68	4.03	6.71
Lordotic posture (the deviation is larger than 40°)	Count	2	0	2
	%	2.56	0	
	% of Total	1.34	0	1.34
Total	Count	78	71	149
	% of Total	52.35	47.65	100

Legend: Pearson's chi-squared test 2.43; Contingency coefficient 0.13; Significance p=0.30.

Of the total sample of participants, lordotic posture was present in 8.05% of the participants, and the incidence of poor posture by gender was uniform.

The values of Pearson's chi-squared test (2.43) and the contingency coefficient (0.13) show an absence of statistically significance between lordotic posture and gender in the participants, with a significance of 0.30.

Descriptive parameters of the postural status in relation to gender and body height groups, as well as the values of Pearson's chi-squared test, the contingency coefficient and the significance are presented in Table 2.

Observed in terms of the BH groups of participants, lordotic posture is most frequent in the group of BH 123.01-127.00 cm, followed by the group of girls of BH 121.51-123.00 cm. The lowest incidence of poor posture was determined in the group of participants of BH of more than 127.01 cm, as well as in the group of BH of less than 119 cm.

Concerning the lordotic posture of the boys, the largest incidence is determined in the group of BH 123.01-127.00 cm and the group of participants with BH of over 127.01 cm. In the other BH groups, there were no cases of scoliotic posture. In the sample of girls, lordotic posture is most frequent in the group of BH 121.51-123.00 cm, and the group of

BH 123.01-127.00 cm. There were no cases of the scoliotic posture at all in the groups of BH up to 119.00 cm and BH over 127.01 cm.

Table 2 Body height and lordotic posture in relation to gender

		Lordotic posture					
		Good posture		Deviation is larger than 30°		Deviation is larger than 40°	
Body height		Boys	Girls	Boys	Girls	Boys	Girls
≤ 119.00 cm	Count	14	20	0	0	0	0
	%	19.44	30.77	0	0	0	0
	% of Total	17.95	28.17	0	0	0	0
119.01-121.50 cm	Count	16	10	0	1	2	0
	%	22.22	15.38	0	16.67	100	0
	% of Total	20.51	14.08	0	1.41	2.56	0
123.01-127.00 cm	Count	13	14	0	3	0	0
	%	18.06	21.54	0	50	0	0
	% of Total	16.67	19.72	0	4.23	0	0
≥ 127.01 cm	Count	14	10	3	2	0	0
	%	19.44	15.38	75	33.33	0	0
	% of Total	17.95	14.08	3.85	2.82	0	0
≥ 127.01 cm	Count	15	11	1	0	0	0
	%	20.83	16.92	25	0	0	0
	% of Total	19.23	15.49	1.28	0	0	0
Total	Count	72	65	4	6	2	0
	%	92.31	91.55	5.13	8.45	2.56	0

Legend: Boys: Pearson's Chi-Squared Test 14.59; Contingency coefficient 0.40; Significance p=0.07; Girls: Pearson's Chi-Squared Test 5.77; Contingency coefficient 0.25; Significance p=0.22

The values of Pearson's chi-squared test of 14.59 in boys and of 5.77 in girls, as well as the contingency coefficient of 0.40 in boys and 0.25 in girls, with a significance of 0.07 in boys and 0.22 in girls, indicate the absence of a statistically significant difference between BH and lordotic posture of participants observed in terms of gender and height groups.

DISCUSSION

The juvenile period (ages 4 to 7) is a critical period in the growth and development when deformities such lordotic posture are formed (Protić-Gava, Krsmanović, Jevtić, Kadović, & Romanov 2009).

Proper posture is evident in a decreasing number of children (Đokić & Stojanović, 2010; Ludwig, Mazet, Mazet, Hammes & Schmitt, 2016). The analysis of all obtained results shows the appearance of lordotic posture associated with body height (Bogdanović & Milenković, 2008; Bogdanović & Marković, 2009; Trajković & Nikolić, 2008). The results obtained in our research do not have statistical significance, but show a tendency of lordotic posture with increasing height. Petrović, Puzović, Đorđević, Obrenović and Jakovljević (2012) conclude that hyperlordosis is present in 9.2% of cases, and that gender and age do not significantly affect the prevalence of this deformity.

The shift in the results of the spinal column parameters depending on the age category can be explained by the fact that the reduction of physical activity of children with the beginning of preschool and school obligations leads to a muscle imbalance which is directly related to spinal deformity and lordosis. Improper and long sitting in front of the TV, the computer, improper carrying of a school backpack, are also reasons for the development of spinal deformities, as well as hunched standing. In order to create an equilibrium position, there is a compensatory movement of the pelvis that leans forward, which leads to an increase in lumbar lordosis. These movements can also lead to the development of other spinal deformities (Andrašić, Milić, Cvetković, Ujsasi, & Orlić, 2017).

The research of other authors, local and foreign, indicate similar tendencies between BH and certain postural disorders, both in the preschool population and later in adolescence.

According to the results of Protić-Gava et al. (2013) on a total sample of 61 participants, aged 8.52 years, lordotic posture prevailed as the most common in: 41% of children was with minor deviations and 13.1% with larger deviations. Similar results, in a population of children aged 6 to 7 were found by Romanov, Stupar, Međedović, and Brkin (2014): the most common was lordotic posture, 41.31% in male participants and 36.66% in female participants. Gh, Alilou, Ghafurinia, & Fereydounnia (2012) point out that the prevalence of lordosis is 22.6% among children aged 5 to 20. Lordosis increases by 6° from the age of 5 to 15 (Widhe, 2001).

Simov, Minić and Stojanović (2011) determined the manifestation of the lordotic posture in 2.07% of preschool children.

Korovljev, Marinković, Roška, and Madić (2015) point out that spinal deformities significantly increase and appear in children of a younger school age compared to preschool children, emphasizing the negative effect of the significantly heavier school bags than recommended (10% of the total weight of the child).

CONCLUSION

The results obtained in this research, observed on the total sample, indicate that lordotic posture was most expressed in the group of boys and girls of BH 123.01-127.00 cm, followed by the group of girls of BH 121.51-123.00 cm. Special attention is required in the prevention, i.e., in the adequate education of the staff of preschool institutions.

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VISINA TELA I LORDOTIČNO LOŠE DRŽANJE DECE PREDŠKOLSKOG UZRASTA

Cilj ovog istraživanja je da se utvrdi odnos između visine tela i lordotično lošeg držanja dece predškolskog uzrasta. Istraživanje je sprovedeno na uzorku od 149 ispitanika (78 dečaka i 71 devojčica), uzrasta 6 godina (±6 meseci), prosečne telesne visine (BH) 121.94±10.29 cm i telesne mase 23.20±4.83 kg, grada Kragujevca (Srbija). U proceni lordotičnog lošeg držanja korišćen je uređaj Spinal Mouse, a sve vrednosti iznad 30° tretirane su kao poremećaji u lumbalnom delu kičmenog stuba. Za utvrđivanje visine tela korišćen je Antropometer po Martinu, a ispitanici su prema visini podeljeni u pet grupa. Postojanje i veličina korelacije između ispitivanih područja izračunati su korišćenjem Pearsonovog Hi kvadrat testa i koeficijenta kontingencije kao mere korelacije. Od ukupnog uzorka, lortodično držanje je zastupljeno u 8.05% ispitanika, a u odnosu na pol, incidenca lordotično lošeg držanja je jednaka. Lortodično loše držanje je najizraženije u grupi dečaka i devojčica BH 123.01-127.00 cm, a sledi grupa devojčica BH 121.51-123.00 cm visine. Najniža incidenca lordotičnog lošeg držanja utvrđena je u grupama BH preko 127.01 cm i ispod 119 cm. Vrednosti Pearsonovog Hi kvadrata testa pokazuju statistički značajnu povezanost između lordotično lošeg držanja i BH, sa nivoom značajnosti od 003.

Ključne reči: *telesna visina, lordotično loše držanje, učestalost, korelacija, predškolska deca*