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# PREVALENCE OF SPINAL DEFORMITIES IN PRESCHOOL CHILDREN LIVING IN THE SOS CHILDREN'S VILLAGE IN SARAJEVO

Original research

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## ABSTRACT

The issue of spinal deformities, which occurs during phases of intense growth in children, has been recognized within the broader community. Certain categories of children are particularly vulnerable to long-term health risks in this regard, making it important to find ways to intervene early and identify such cases. This study was conducted to assess the current state of spinal posture during one of the most sensitive phases of physiological development in a special group of preschool children. In this case, the sample included 92 preschool children aged 4 to 6 years, who have been living and growing up from an early age in the SOS Children's Village in Sarajevo, without the presence of their biological parents. The assessment of poor posture was applied according to Napoleon Wolanski (1975), which is based on determining the relationships between segmental dimensions as follows: D1 – assessment of head posture (HPA), D2 – assessment of shoulder posture (SPA), D3 – assessment of chest posture (CPA), D4 – assessment of scapula posture (SBPA), D5 – assessment of spinal posture (SP), D6 – assessment of abdominal posture (APA), D7 – assessment of leg posture (LPA), D8 – assessment of foot posture (FPA). Deviations are classified according to their severity and are assessed with so-called negative points, where: 0 points indicate no deviation, 1 point indicates a mild deviation, and 2 points indicate a significant deviation. The posture results show that 15.2% of the children have scoliosis, while 13.0% have lordosis, and 7.6% of preschoolers have kyphosis. Additionally, 30.4% of the children have flat feet, which predisposes them to long-term spinal problems, and 33.7% have significant deviations in leg posture. Numerical values of the results indicate that none of the children included in the testing had an ideal shoulder posture, i.e., a score of 0, which implies no deviation from normal, while the head posture results were also extremely poor.

**Keywords:** poor posture, spine, preschool age

## INTRODUCTION

The spine has four physiological curves, two anterior in the cervical and lumbar regions, and two posterior in the thoracic and sacral regions. These curves are essential for maintaining body stability during movement and for keeping a stable center of gravity (Bajek et al., 2007). Any deviation from the normal degree of spinal curvature is considered a deformity (Muftić et al., 2010). During childhood, there is a high prevalence of postural deviations, estimated at 20%,

which is not only concerning but also represents a public health issue (Prado Viera, 2015). The posture of children is an extremely important aspect of their health status and has become the focus of many researchers, especially as postural disorders are increasingly common in children and adolescents (Obradović & Milošević, 2008; Krneta, 2010). Changes, in terms of deviations from normal postural status, frequently occur during growth and



development (childhood and adolescence). According to McEvoy and Grimmer (2005), postural control develops segmentally in a cephalocaudal direction, starting with the establishment of head control, then the torso, and finally achieving postural stability while standing. The motor and sensory systems responsible for postural stability undergo a transition between the ages of four and six, reaching adult maturity between seven and ten years (Lafond, Descarreaux, Normand, & Harrison, 2007). Identifying postural disorders is of utmost importance, particularly during preschool years. This is because early formation of a "good posture pattern" created in early childhood not only contributes to proper growth and development but also positively impacts long-term health and quality of life (Protić-Gava & Krneta, 2010). Factors affecting posture can be endogenous or exogenous. Endogenous factors, such as heredity, cannot be influenced, but there are significantly more exogenous causes (physical activity, living environment, etc.) that can be influenced (Demeši-Drljan, 2012). Children are engaging less in play and physical activity, such as sports, while spending more time in passive positions, sitting or lying down (Cvetković & Perić, 2009).

The sample consisted of 92 boys and girls aged 4-6 who were attending a preschool located in the SOS Hermann Gmeiner Children's Center, also located in the Novi Grad Municipality of Sarajevo. The method used to assess body posture, indicating the state of specific body segments, was based on the Napoleon Wolanski evaluation. After assessing the body segments, a posture scale was derived for the children based on the total scores. Data processing using the SPSS program and descriptive statistics revealed significant health issues within this group of children. The results showed that in the sample ( $n = 92$ ), scoliosis predominated (15.2%), which is a spinal deformity involving abnormal lateral curvature. A normal spine has a slight curve, but in scoliosis, this curvature is more pronounced. Symptoms of scoliosis can vary depending on the severity of the curvature and individual characteristics of the patient. Some common manifestations include unequal shoulder height, uneven hip height, back pain, fatigue, difficulty breathing, or lung compression in severe cases. There are different types of scoliosis, with idiopathic scoliosis being the most common type found in children and adolescents, where the cause is often unknown. It can be either infantile idiopathic scoliosis (appearing before puberty) or adolescent idiopathic scoliosis (appearing during puberty). Neuromuscular scoliosis is found in individuals with neuromuscular disorders such as cerebral palsy or muscular dystrophy, congenital scoliosis occurs due to abnormal spinal development during pregnancy, and degenerative scoliosis is

present in adults due to degenerative changes in the spine, such as disc degeneration or osteoarthritis.

Following scoliosis, the second most prevalent condition was kyphosis (13.0%), characterized by a forward curvature of the spine, often referred to as "round back" or "hunchback." Normally, the spine has a natural kyphosis in the thoracic region (upper back), but when this curve is exaggerated, it is considered kyphosis. Various types of kyphosis are recognized in medicine, with postural kyphosis being the most common form, typically caused by poor posture, muscle weakness, or bad posture habits. Postural kyphosis is usually temporary and can often be corrected through exercises to strengthen muscles and improve posture. Other less common forms include Scheuermann's kyphosis, which occurs during adolescence and is characterized by abnormal growth of the vertebrae, leading to more pronounced spinal curvature; degenerative kyphosis, which affects older adults due to degenerative spinal changes, including bone density loss (osteoporosis) and disc degeneration; and congenital kyphosis, caused by abnormal spinal development during pregnancy.

The prevalence of scoliosis in this sample was significantly higher than described in current literature. It is evident that certain categories of children are at higher risk for these musculoskeletal disorders. Poor posture was also common in this sample. Clearly, early social factors play an important role in the motor development of children growing up without parents. This finding highlights the need for early intensive intervention targeting these children.

## METHODS

### Participants and procedure

The sample consisted of 92 preschool-aged children, both boys and girls, aged 4 to 6 years, who live in the SOS Children's Village in Sarajevo. A series of anthropometric measurements were collected, including weight, height, body posture, and the posture of legs and feet. The average values for the sample were: height - 111.9 cm, weight - 20.22 kg, and body mass index (BMI) - 15.99. The assessment of poor posture was applied according to Napoleon Wolanski (1975), which is based on determining the relationships between segmental dimensions as follows:

- D1 – assessment of head posture (HPA),
- D2 – assessment of shoulder posture (SPA),
- D3 – assessment of chest posture (CPA),
- D4 – assessment of scapula posture (SBPA),
- D5 – assessment of spinal posture (KYSP), (SCSP), (LOSP)

- D6 – assessment of abdominal posture (APA),
- D7 – assessment of leg posture (LPA),
- D8 – foot posture (FPA).

Deviations were classified based on their severity and assessed with so-called negative points, where:

- 0 points indicate no deviation,
- 1 point indicates a mild deviation,
- 2 points indicate a significant deviation.

### Measuring instruments and variables

A social distance scale (Šlezak and Šakaja, 2012). The aim of this scale was to examine the classic measure of open prejudice, i.e. different levels of closeness, starting with the closest ones and towards the furthest ones, to which an individual is ready to agree with members of the Roma ethnic minority. The measuring instrument included seven degrees of closeness, which are arranged from higher to lower. The participant's task was to evaluate his degree of closeness, or (dis)agreement with the ethnic Roma national minority on a seven-point Likert-type scale. During processing, the total score for each social group was added up, and it varied from 1–7. The items were coded so that the total score on the scale was equal to the sum of the affirmative answers. The results on the scale were reverse scored, so a higher score indicates a greater degree of social distance towards the Roma, while a lower score on the scale, due to intuitiveness and congruence with the feeling thermometer, signals a lower degree of ethnic distance towards the examined social group. Therefore, if the participant answered that he agreed to the closest contact ("best friend") with a member of the Roma social group, his social distance is 0, that is, there is none. However, if he did not agree to the closest contact, but agreed to another contact based on closeness ("he trains with me at the club"), his social distance is 1. The furthest level of closeness refers to "I would drive him out of the country" and if the participant only agreed to that "contact", then the social distance is maximum and amounts to 6. The total social distance consists of the sum of the social distances, and the maximum score of the total social distance is 36. The internal reliability coefficient Cronbach's alpha (in this sample is  $\alpha = 0.82$ , which confirms the satisfactory internal consistency of the used scale (Tabachnick et al., 2019).

Big Five Inventory – BFI (Benet Martinez and John, 1998). The BFI measures the basic traits of the five-factor model of personality. The instrument includes a total of 44 items in the form of short verbal phrases for self-assessment of five basic personality traits, e.g. extraversion (8 items), agreeableness (9 items), conscientiousness (9 items), neuroticism (8 items) and openness to experience (10 items). The

participant's task was to evaluate on a five-point Likert-type scale the extent to which they agree with the listed characteristics from "I completely disagree" to "I completely agree". The results are expressed partially by subscales, as the arithmetic mean of the participant's answers, where a higher score indicates a greater expression of a certain personality dimension in the individual, i.e. that a person is more characterized by his individual traits, while a lower score indicates a less pronounced individual personality trait. Cronbach's alpha coefficient of internal consistency of the questionnaire in this research ranges from 0.70 to 0.95, namely: for extraversion ( $\alpha = 0.80$ ), agreeableness ( $\alpha = 0.75$ ), conscientiousness ( $\alpha = 0.89$ ), neuroticism ( $\alpha = 0.90$ ) and openness to experience ( $\alpha = 0.95$ ). The calculated values according to Figel (2013) show acceptable reliability of the used measuring instrument, because the lower limit value is greater than 0.70.

Right-Wing Authoritarianism – RWA (Tomić, Huić and Čepuljić, 2013). RWA examines three aspects of right-wing authoritarianism: authoritarian aggression, conventionality, and authoritarian submissiveness within a social group. The measuring instrument contains 15 declarative statements (for example, It is necessary to censor the media so that people do not come into contact with destructive and disgusting information; The most important virtues that children should learn are obedience and respect for authority; Traditional customs and values are still the best guidelines for life). Five-point numeric-descriptive scales of the Likert type with a format of five levels of agreement/disagreement (from 1 = not important at all/does not apply to me at all to 5 = very important/applies to me completely) were used, where 1 expresses complete disagreement, and 5 complete agreement with the content of the statement. After recoding, the definitive score on the scale represents the sum of responses to all items. Agreement with the odd items and disagreement with the even items expresses an authoritarian attitude, where a higher score expresses a higher level of authoritarian attitudes. The reliability of internal consistency of Cronbach's alpha for the applied subscales on this sample is: authoritarian submissiveness ( $\alpha = 0.80$ ), authoritarian aggression ( $\alpha = 0.78$ ) and conventionality subscales ( $\alpha = 0.82$ ), which signals the satisfactory reliability of the measuring instrument.

### Statistical analysis

Descriptive parameters of central tendency and variability were calculated for all variables included in the analysis. Data are presented as percentages. Data processing was done using IBM SPSS (version 21 software, Chicago, IL, USA).

## RESULTS

Descriptive analysis identified the characteristics of the subjects, both boys and girls ( $N = 92$ ), and these are presented in Table 1.

**Table 1.** Sample characteristics

	N	Min	Max	Mean	SD
Hight	92	91.0	126.0	111.912	7.3005
weight	92	10	37	20.22	4.706
BMI	92	9.79	24.46	15.9933	2.44068

**Table 2.** Frequencies and prevalence of deformities

		F	%			F	%	
		0	9	9.8	0		36	39.1
HPA	1	35	38.0	LOSP	1	44	47.8	
	2	48	52.2		2	12	13.0	
	0	0	0		0	33	35.9	
SPA	1	74	80.4	SCSP	1	45	48.9	
	2	18	19.6		2	14	15.2	
	0	9	9.8		0	19	20.7	
SBPA	1	63	68.5	APA	1	51	55.4	
	2	20	21.7		2	22	23.9	
	0	64	69.6		0	13	14.1	
CPA	1	22	23.9	LPA	1	48	52.2	
	2	6	6.5		2	31	33.7	
	0	42	45.7		0	10	10.9	
KYSP	1	43	46.7	FPA	1	54	58.7	
	2	7	7.6		2	28	30.4	

The numerical and percentage representation of postural deviations from normal, as well as lower extremities and feet abnormalities, are shown in Table 2.

In general, a significant percentage of the tested population exhibited notable deviations from normal posture, especially in terms of:

- head posture with 52.2%,
- abdominal posture with 23.0%,
- scapula posture with 21.7%,
- and shoulder posture with 19.6%.

The alarming prevalence of spinal deformities was observed in the form of scoliosis in 14 children (15.2%), lordosis in 12 preschoolers (13%), and kyphosis in 7 children (7.6%) of the tested sample. Abnormalities in the appearance of the lower extremities were detected in 31 children (33.7%), and flat feet were identified in 28 children, representing 30.4% of the sample.

## DISCUSSION

Based on the conducted research, the results show significant deviations from normal postural status present in a large percentage of the treated sample. Scoliosis can be defined as a curvature of the thoracolumbar spine greater than  $10^\circ$  in the coronal plane (Sharma et al., 2015). It is the most common pediatric musculoskeletal disorder, with a prevalence of around 3% (Koniczny, Senyurt, & Krauspe, 2012).

The American Orthopedic Association reports an annual incidence of musculoskeletal abnormalities in 9.6 million children under the age of 19 (Sudo H., Kokabu T., Abe Y., 2007). Scoliosis is generally the most common diagnosis for children in physical therapy clinics (M. & Damázio L.C.M., 2017). Prado Viere et al. (2015) confirmed a prevalence of 26.3% in preschool-aged children. The prognosis for scoliosis is generally worse the earlier the condition develops. Idiopathic adolescent scoliosis, which occurs during periods of rapid growth, is the most common form (Public Health Institute of Dubrovnik-Neretva County, 2021). Various treatment methods exist (Esposito et al., 2012).

Scoliosis occurs in about 4% of the world population, more frequently in adolescent girls than boys. The occurrence rate for girls aged 7 is 36%, for girls aged 8 it remains 36%, and for girls aged 10, it rises to 52%. To prevent the development of functional scoliosis, stretching exercises in different positions—standing, sitting, kneeling, and lying—are essential. Proper breathing techniques and massage to prepare and relax the muscles are needed to eliminate muscular and ligament tension. It is also important that children engage in sports and recreational activities that raise awareness of resisting external factors leading to a scoliotic posture (Kosinac, 2002). Postural scoliosis can lead to true scoliosis with bone deformities, but this is rare, especially when physical exercises are performed correctly, reducing the likelihood of progression to true scoliosis (Adams et al., 2001).

Poor lordotic posture in preschoolers is present in about 40% of cases, indicating an increasing trend of daily inactivity in this population. This can result from prolonged improper sitting, which weakens the abdominal muscles and shortens the back muscles (Romanov et al., 2014). Foot deformities, particularly flat feet, were identified in 60% of the participants. There was no statistically significant difference between genders (Romanov et al., 2014). Similar findings were obtained in a study by Mihajlović et al. (2010), who, in their comprehensive analysis, found nearly identical results for lowered longitudinal foot arches in girls aged six and seven as reported in previous research.

## CONCLUSION

It is important to emphasize that the research results support the increasing prevalence of a sedentary lifestyle among preschool children, mainly caused by the early exposure to digital technologies. Additionally, certain categories of children are evidently at greater risk for musculoskeletal disorders, with early social factors playing a significant role in the motor development of children growing up without parents. It is crucial to provide children with age-appropriate furniture in kindergartens and to encourage the

development of healthy habits related to physical activity and proper nutrition (Mihajlović, 2021).

All of the above indicates the urgency and necessity of early involvement of preschool-aged children in organized corrective treatments, as well as the implementation of corrective-preventive kinesiology programs in their daily activities. This is the only way to prevent the potential development of current diagnosed conditions into structural disorders of the spine and the musculoskeletal system.

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## Conflict of Interest

The authors do not have any conflicts of interest to disclose. All co-authors have reviewed and concurred with the manuscript's content, and no financial interests need to be reported.