International Journal of Biomedicine 14(3) (2024) 484-491
http://dx.doi.org/10.21103/Article14(3)_OA16

ORIGINAL ARTICLE

Pediatrics

INTERNATIONAL JOURNAL OF BIOMEDICINE

Investigations of Spinal Abnormalities among Elementary School Pupils in the Municipality of Peja

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Abstract

Background: Almost 30% of children and adolescents complain of back pain, and very few of them consult a doctor or physiotherapist about it. This study aimed to identify the prevalence of spinal deformities among Grade V and VI students, determine the contributing factors, and evaluate gender differences in the occurrence of spinal deformities.

Methods and Results: This cross-sectional study was based on a systematic analysis of reality using a questionnaire and a physical examination (spinal observation and Adam's forward bend test for scoliosis). The study included 293 pupils (143 girls and 150 boys) from three elementary schools in the Municipality of Peja.

Based on our study's findings, the most prevalent spinal deformity observed was moderate to severe kyphosis signs, accounting for 29.7%, followed by moderate to severe scoliosis (16.4%), alterations in cervical and lumbar lordosis (16.0%), mild scoliosis signs (14.7%), diagnosed scoliosis (11.9%), mild kyphosis signs (9.6%), and diagnosed kyphosis (1.7%). The prevalence of deformities was higher in girls. Our findings revealed moderate and strong positive correlations between the school-home distance and all spinal deformities treated in this study (P=0.000 in all cases). In addition, there were weak positive correlations between the schoolbag weight and moderate to severe scoliosis signs, moderate to severe kyphosis signs, and changes in cervical and lumbar lordosis (P<0.05 in all cases).

Conclusion: Heavy backpacks and school-home distance are contributing factors to spinal deformities. These findings emphasize the necessity for interventions addressing backpack weight, school-home distance, and gender-specific considerations to reduce spinal deformities among students.**(International Journal of Biomedicine. 2024;14(3):484-491.)**

Keywords: spinal deformities • pupils • contributing factors • prevention

For citation: Kabashi D, Hoti F, Krasniqi L, Hoxha F, Ukëhaxhaj A. Investigations of Spinal Abnormalities among Elementary School Pupils in the Municipality of Peja. International Journal of Biomedicine. 2024;14(3):484-491. doi:10.21103/Article14(3)_OA16

Introduction

Almost 30% of children and adolescents complain of back pain, and very few of them consult a doctor or physiotherapist about it. This problem is more frequent in children and adolescents between 8 and 18 years of age.[(1)]

In most cases (80%), the causes are idiopathic, but several factors can influence the occurrence of spinal deformities in children and adolescents. Incorrect posture, prolonged persistence in a forced position, or external factors can lead to deforming changes in the spinal axis. Many problems are also due to inborn (congenital) pathologies reflected in the body's asymmetry.[(2)]

A backpack full of books, using electronics like laptops, cell phones, big totes filled with children's books, or spending too much time in front of the TV are further risk factors for spine abnormalities in children. For many parents, this ongoing worry presents a continual challenge.

The flexibility of the spine makes specific kinds of movements possible. Children's "immature" spines make it

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very easy for alterations to happen that exceed what is normal, especially if we put too much strain on them. Children's bad posture when standing and performing daily tasks and their bad posture when using a work chair or school desk might cause spinal issues.[2]

Implementing such a study is deemed useful and extremely necessary since the incidence of cases involving changes in the spine in adults, children, and adolescents is becoming increasingly problematic, and the development of studies on this problem is lacking and not treated as it should be, particularly in Kosovo. Children can have a high quality of life by preventing the harmful effects of motor sequelae and spinal abnormalities through prevention, early diagnosis, treatment, and rehabilitation.

Scoliosis is characterized by a lateral curvature with rotation of the vertebrae within the curve that deviates from the spine's normal vertical line. According to the Scoliosis Research Society (SRS), scoliosis is radiologically defined as a lateral spinal curve exceeding 10° in a radiograph, with vertebra rotation.[3]

Scoliosis has several origins, which may be roughly categorized as congenital, neuromuscular, syndrome-related, idiopathic, and spinal curvature due to secondary causes. It may result from muscular abnormalities (Duchenne muscular dystrophy), neurological disorders (Marfan syndrome and neurofibromatosis), or muscle ailments (cerebral palsy or paralysis).[4]

Scoliosis treatment can be either conservative or surgical. Non-operative treatment consists of observation, physiotherapy and/or bracing. The SRS guidelines report observation or physiotherapy for curves below 25 degrees, brace indication between 25° and 40°, at a growth stage Risser 0–3.[3] Most experts would recommend surgery only when the spinal curve is greater than 40° and there are signs of progression.[5]

A larger curvature of the thoracic portion of the spine is known as kyphosis, or forward curving of the torso; it is also referred to as a "hump" in the spine. When one is seated, this is most apparent when the shoulders roll forward, giving the illusion of being unnaturally rounded. It frequently happens due to the child's rapid growth, incorrect seating, and weak abdominal and back muscles. Some development abnormalities can lead to adolescent kyphosis.[6]

Thoracic kyphosis of more than 50 degrees with normal-shaped vertebrae is known as postural kyphosis or postural round back. This kind of kyphosis is adaptable and frequently gets better with exercise.

Scheuermann's kyphosis is a kind of kyphosis in which the vertebrae have taken on the shape of a wedge. The rigidity of this kind of kyphosis might worsen with growth. Scoliosis affects men and women equally, with 0.4% of the population affected by this disease.[6]

The articulated ebb and flow of the spine, known as hyperlordosis, can occur in either the cervical or lumbar areas of the spine (waist regions), causing pain and discomfort in the neck and lower back.[7]

Lumbar hyperlordosis: In people with increased lumbar lordosis, distortion is visible in the lower back. When the person is viewed in profile, the abdomen is pulled outward, the pelvis is further back, and the gluteal portion is more rotated. Lumbar hyperlordosis of the spine causes pain in the lumbar part of the back and in the pelvis. It is caused by incorrect posture. Other causes can be flat feet and excessive body weight.[8]

Cervical hyperlordosis: In individuals with greater cervical lordosis, alteration is seen in the neck area, where the usual curve of the neck has been deepened, and the head has been tilted forward. It is typically brought on by bad posture; if it is not fixed, it worsens and develops other symptoms. Rarely, lumbar hyperlordosis can cause a person to have abrupt, acute leg pain or paralysis or to lose control of their bladder or bowels.[8]

In an "immature" spine, such as that of children, it is very easy for changes to occur that exceed what is permissible, especially if the spine is heavily loaded, e.g., by 15% more than the child's body weight.[9] If spinal abnormalities are not recognized and treated before age 18, serious problems develop, making it challenging to achieve visible improvements. The danger reaches fatality in cases of curves above 40 degrees.

The risk for women lies in the fact that women will become mothers, and in the coming years, there will also be birth pressures. Those deformations, which are at the thoracic level, risk squeezing the organs and obstructing breathing. In addition to the aesthetic risk, the deformities cause rapid fatigue, shortness of breath, back pain, leg pain, etc.[10]

Children can have a high quality of life by preventing the harmful effects of motor sequelae and spinal abnormalities through prevention, early diagnosis, treatment, and rehabilitation.[11-13]

Deformities of the spine are known as a "modern phenomenon," and it is believed that the structural deformities of the spine are caused by carrying heavy bags or playing with cell phones or electronic games for hours. Approximately 29000 surgeries to correct adolescent idiopathic scoliosis are performed annually in the United States.[14] These deformities range from hyperkyphosis and sagittal imbalance to more complex three-dimensional conditions like adolescent idiopathic scoliosis.

In Kosovo, especially in rural areas, students travel 500 m -1 km from home to school. Based on this study, most students travel on foot to school; only a small number use public transport or cars.

This study aimed to identify the prevalence of spinal deformities among Grade V and VI students, determine the contributing factors, and evaluate gender differences in the occurrence of spinal deformities.

Material and Methods

Study Design and Participants

This cross-sectional study was based on a systematic analysis of reality using a questionnaire and a physical examination (spinal observation and Adam's forward bend test for scoliosis). The study was conducted from November to December 2022. With the approval of the Municipal

Directorate of Education of the Municipality of Peja and in collaboration with the Regional Center for Public Health - Peja. Three elementary schools in the Municipality of Peja (SCH 1, SCH2, SCH 3) were selected for this study. This study included 293 pupils (143 girls and 150 boys) in the fifth and sixth grades (Table 1).

Table 1.

Study students' characteristics.

Variable	SCH1 N=92 [1]	SCH2 N=123 [2]	SCH3 N=78 [3]	*P*-value
Gender distribution				
F	40.7%	38.5%	56.5%	
M	59.3%	61.5%	43.5%	
Age (years)	10.94±0.63	10.70±0.61	10.92±0.56	F=5.2411, P=0.0058 P_{1-2}=0.0117, P_{1-3}=0.9747 P_{2-3}=0.0329
Body weight, kg	43.96±13.20	42.98±10.43	47.86±11.34	F=4.4187, P=0.0129 P_{1-2}=0.8132, P_{1-3}=0.0755 P_{2-3}=0.0109
Body height, m	1.48±0.069	1.50±0.067	1.53±0.073	F=11.0630, P=0.0000 P_{1-2}=0.0926, P_{1-3}=0.0000 P_{2-3}=0.0004
Bag weight, kg	4.89±0.88	1.50±0.067	4.95±0.954	F=856.7229, P=0.0000 P_{1-2}=0.0000, P_{1-3}=0.8420 P_{2-3}=0.0000
Min	3.4	2.6	3	
Max	7.5	7.5	8.2	

According to the findings in Table 1, male pupils dominated in SCH1 (59.3%) and SCH2 (61.5%). Conversely, in SCH3, the dominance shifted to female pupils (56.5%). The average age of pupils was notably higher in SCH1: 10.94±0.63 years vs.10.70±0.61 years in SCH2 and 10.92±0.56 years in SCH3, *P*=0.0058. Regarding body weight, pupils in SCH3 reported a higher average body weight of 47.86±11.34 kg vs. 43.96±13.20kg in SCH1 and 42.98±10.43kg in SCH2, *P*=0.0129. Similarly, for body height, pupils in SCH3 also reported a higher average of 1.53±0.073m vs. 1.48±0.069m in SCH1 and 1.50±0.067m in SCH2, *P*=0.0000. Regarding bag weight, the pupils of SCH3 reported the highest average (4.95±0.954kg vs. 4.89±0.88kg in SCH1 and 1.50±0.067kg in SCH2, *P*=0.0000).

Study Questionnaire

A self-created questionnaire was used to collect information on pupils' knowledge, attitudes, and practices regarding spinal deformities. The questions were carefully selected to suit the purpose of the study. The questionnaire contains 16 closed-ended questions, and the answers are arranged according to alternatives (Yes or No). In addition to the study questions, socio-demographic questions were presented to the pupils.

Physical Examination Procedure

Observation

The observation included a complete inspection of the child from three angles (front, side, and back), and each observed change in the student's back, inconsistency in limb length, change in lumbar angle, etc., is marked.

Adam's forward bend test

The examiner stands behind the student and stares along the horizontal plane of the spine. The student bends forward at the waist until the back comes in the horizontal plane, with feet together, arms hanging, and knees extended. The examiner looks for scoliosis symptoms, such as spinal asymmetry, uneven shoulders, scapula asymmetry, uneven hips, a hip bone that is out of alignment with the pelvis, or a rib hump.

We described and labeled each change noted. Each student found to have changed was guided toward diagnosis and appropriate professional treatment. Each student's physiotherapeutic examination was conducted so that his/her privacy was fully preserved.

Statistical Analysis

The Statistical Package for the Social Sciences software (SPSS version 21.0, SPSS Inc, Armonk, NY: IBM Corp)) was utilized for data analysis. Categorical variables were summarized using frequencies (n) and percentages (%), while continuous variables were summarized using mean ± standard deviation (SD). Group comparisons with respect to categorical variables are performed using the chi-square test. Multiple comparisons were performed using a one-way ANOVA and Tukey HSD post-hoc test. Pearson's Correlation Coefficient (r) was used to determine the strength of the relationship between the two continuous variables. In addition, a linear regression analysis was performed to assess the impact of pupils' bag weight on noticeable scoliotic changes. A probability value of $P<0.05$ was considered statistically significant for all conducted statistical tests.

Results

In our study, the survey indicated that the students' travel distances to the school ranged from 500 meters to one kilometer. However, there have been instances where kids have taken the bus. Thus, kids had to carry their heavy baggage daily from home to school.

Table 2 shows pupils' responses regarding their awareness of spinal deformities, contributing factors, physical activity participation, observed back changes, and seeking professional advice. Most participating pupils are unfamiliar with spinal deformities (SCH1=75.0%, SCH2=73.20%, SCH3=51.30%). Furthermore, most pupils know that incorrect posture, excessive TV watching, and heavy bags contribute to these issues (SCH1=66.30%, SCH2=74.0%, SCH3=74.0%). Most pupils report engaging in physical activity (SCH1=67.0%, SCH2=55.0%, SCH3=55.0%). Many of the pupils have noticed changes in their spinal posture (SCH1=52.0%, SCH2=80.0%, SCH3=83.0%), yet most of them have not consulted a healthcare professional regarding this matter (SCH1=81.0%, SCH2=84.0%, SCH3=72.0%).

Table 2.

Pupils' responses to the questionnaire.

	SCH1	SCH2	SCH3
Are you familiar with spinal deformities?			
Yes	25.00%	26.80%	48.70%
No	75.00%	73.20%	51.30%
Did you know that incorrect posture, watching TV, and heavy bags are contributing factors?			
Yes	66.30%	74.00%	74.00%
No	33.70%	26.00%	26.00%
Participation in sports or PA (at least 2 times per week)			
Yes	67.00%	55.00%	55.00%
No	33.00%	45.00%	45.00%
Have you noticed any changes in your back (or back pain) lately?			
Yes	52.00%	80.00%	83.00%
No	48.00%	20.00%	17.00%
Have you visited the doctor or physiotherapist for advice?			
Yes	19.00%	16.00%	28.00%
No	81.00%	84.00%	72.00%

The prevalence of spinal abnormalities according to gender for the three schools is shown in Tables 3, 4, and 5. In SCH1 and SCH3, the female students exhibited higher scores for all deformities (P<0.05 in all cases). In SCH2, female pupils exhibited higher scores for all deformities compared to male pupils (P<0.05), except for the "mild kyphosis signs" (P>0.05).

Table 3.

Prevalence of spinal deformities by gender differences: SCH1.

SCH1	Gender	Mean	SD	*P*-value
Mild scoliosis signs	F	2.00	0.000	0.001
	M	1.76	0.431	
Moderate to severe scoliosis signs	F	2.00	0.000	0.001
	M	1.78	0.418	
Mild kyphosis signs	F	2.00	0.000	0.011
	M	1.86	0.350	
Moderate to severe kyphosis signs	F	2.00	0.000	0.000
	M	1.72	0.453	
Changes in cervical and lumbar lordosis	F	2.00	0.000	0.006
	M	1.84	0.370	

Table 4.

Prevalence of spinal deformities by gender differences: SCH2.

SCH2	Gender	Mean	SD	*P*-value
Mild scoliosis signs	F	2.00	0.000	0.015
	M	1.82	0.379	
Moderate to severe scoliosis signs	F	2.00	0.000	0.015
	M	1.82	0.379	
Mild kyphosis signs	F	2.00	0.000	0.062
	M	1.51	0.505	
Moderate to severe kyphosis signs	F	2.00	0.000	0.000
	M	1.72	0.453	
Changes in cervical and lumbar lordosis	F	2.00	0.000	0.000
	M	1.68	0.471	

Table 5.

Prevalence of spinal deformities by gender differences: SCH3.

SCH3	Gender	Mean	SD	*P*-value
Mild scoliosis signs	F	2.00	0.000	0.000
	M	1.56	0.500	
Moderate to severe scoliosis signs	F	2.00	0.000	0.000
	M	1.45	0.502	
Mild kyphosis signs	F	2.00	0.000	0.000
	M	1.05	0.233	
Moderate to severe kyphosis signs	F	2.00	0.000	0.000
	M	1.05	0.233	
Changes in cervical and lumbar lordosis	F	2.00	0.000	0.000
	M	1.54	0.502	

Table 6 displays the results depicting the prevalence of spinal deformities categorized by schools. The results indicate significant differences among the schools regarding the prevalence of deformities treated in this study.

The correlation analysis presented in Table 7 was conducted to assess the potential relationship between spine deformities, the weight of pupils' bags, and the school-home distance. The results demonstrate a weak positive correlation between the bag weight and moderate to severe scoliosis signs (r=0.124, P=0.033), moderate to severe kyphosis signs (r=0.204, P=0.001), and the changes in cervical and lumbar lordosis (r=0.124, P=0.034). We found moderate and strong positive correlations between the school-home distance and all spinal deformities treated in this study (P=0.000).

Table 6.

Prevalence of spinal deformities in the study schools.

Mild scoliosis signs			
	Yes n (%)	No n (%)	*P*
SCH1	12(4.1)	80(27.3)	0.000
SCH2	31(10.6)	92(31.4)	
SCH3	0(0)	78(26.6)	
Moderate to severe scoliosis signs			
	Yes n (%)	No n (%)	*P*
SCH1	11(3.8)	81(27.6)	0.000
SCH2	37(12.6)	86(29.4)	
SCH3	0(0)	78(26.6)	
Diagnosed scoliosis			
	Yes n (%)	No n (%)	*P*
SCH1	2(0.7)	90(30.7)	0.000
SCH2	22(7.5)	101(34.5)	
SCH3	0(0)	78(26.6)	
Mild kyphosis signs			
	Yes n (%)	No n (%)	*P*
SCH1	7(2.4)	85(29.0)	0.000
SCH2	21(7.2)	102(34.8)	
SCH3	0(0)	78(26.6)	
Moderate to severe kyphosis signs			
	Yes n (%)	No n (%)	*P*
SCH1	14(4.8)	78(26.6)	0.000
SCH2	68(23.2)	55(18.8)	
SCH3	5(1.7)	73(24.9)	
Diagnosed kyphosis			
	Yes n (%)	No n (%)	*P*
SCH1	0(0)	92(31.4)	0.03
SCH2	5(1.7)	117(40.3)	
SCH3	0(0)	78(26.6)	
Changes in cervical and lumbar lordosis			
	Yes n (%)	No n (%)	*P*
SCH1	8(2.7)	84(28.7)	0.000
SCH2	39(13.3)	84(28.7)	
SCH3	0(0)	78(26.6)	

Table 7.

Correlation analysis data.

	MSS	MSSS	MKC	MSKS	CCLL	BW
MSS						
MSSS	**r=0.911** P=0.000					
MKC	**r=0.784** P=0.000	**r=0.734** P=0.000				
MSKS	**r=0.638** P=0.000	**r=0.681** P=0.000	**r=0.500** P=0.000			
CCLL	**r=0.844** P=0.000	**r=0.812** P=0.000	**r=0.744** P=0.000	**r=0.673** P=0.000		
BW	**r=0.112** P=0.054	**r=0.124** P=0.033	r=0.084 P=0.151	**r=0.204** P=0.001	**r=0.124** P=0.034	
SHD	**r=0.623** P=0.000	**r=0.640** P=0.000	**r=0.504** P=0.000	**r=0.716** P=0.000	**r=0.659** P=0.000	r=0.200 P=0.001

MSS - mild scoliosis signs; MSSS - moderate to severe scoliosis signs; MKS - mild kyphosis signs; MSKS - moderate to severe kyphosis signs; CCLL - changes in cervical and lumbar lordosis; BW - bag weight; SHD – school-home distance.

*The magnitude of the Pearson correlation: **very strong**, **strong**, **moderate**, **weak**.*

Discussion

Based on our study's findings, the most prevalent spinal deformity observed was moderate to severe kyphosis signs, accounting for 29.7%, followed by moderate to severe scoliosis (16.4%), alterations in cervical and lumbar lordosis (16.0%), mild scoliosis signs (14.7%), diagnosed scoliosis (11.9%), mild kyphosis signs (9.6%), and diagnosed kyphosis (1.7%). These results highlight a concerning trend among the studied students, indicating the presence of spinal deformities in both the sagittal plane (kyphosis, cervical, and lumbar lordosis) and the frontal plane (scoliosis). Our results agree with the data from numerous studies. A study conducted in Slovakia by Rusnák et al.,[11] aiming to assess and identify spinal deformities in primary school students (311 healthy pupils), revealed poor posture in more than 50% of the pupils studied. Specifically, spinal irregularities in the sagittal plane were observed in more than 30%, with distinct breakdowns noted in the cervical, thoracic, and lumbar regions (37.94%, 32.15%, and 30.22%, respectively). Moreover, approximately 13% of the pupils manifested deformities in the frontal plane.

A meta-analysis conducted by Taleschian-Tabrizi et al.[15] encompassed 18 studies to assess spinal deformities in primary school students (n= 84195, mean age of 12.71±1.18 years). The total prevalence of kyphosis, scoliosis, and lordosis was 13.06%, 2.61%, and 32.59%, respectively. The prevalence of deformities was higher in girls. Interestingly, lordosis exhibited the highest prevalence in contrast to our study, with a higher prevalence of moderate to severe kyphosis signs.

It is known that the ratio of the student's weight to the weight of the backpack is essential in forming posture. Evidence supports that heavy backpacks contribute to childhood back pain.[9,16-18] Forty-four percent of students report discomfort carrying their backpacks,[18] and 82% of children who complain of pain attributed their pain to backpack wear.[19] Excessive school bag weight leading to low back pain forms the basis for the recommended load limits of 10% to 15% of a child's body weight by many health professional associations (the American Physical Therapy Association, 2017; the American Occupational Therapy Association, 2017). Many researchers reported that a load of 10% of the student's body weight was the appropriate maximum weight to be carried by students to limit the effects of load discomfort, injuries, and other adverse impacts.[20-29] Given the distance from home to school, this question becomes even more relevant. In our study, 33.44% of students wear heavy backpacks while covering a distance of 500 m - 1 km daily.

Our findings revealed moderate and strong positive correlations between the school-home distance and all spinal deformities treated in this study (P=0.000 in all cases). In addition, there were weak positive correlations between the schoolbag weight and moderate to severe scoliosis signs, moderate to severe kyphosis signs, and changes in cervical and lumbar lordosis (P<0.05 in all cases). These results confirm that the schoolbag weight and school-home distance contribute to the prevalence of spine deformities among pupils. About this matter, our findings align with the outcomes of a study conducted by Walicka-Cupryś et al.[30] Their study aimed to determine a correlation between the weight of a child's backpack, their body weight, and certain features of their body posture. The study group consisted of 109 children, all aged seven years. The authors concluded that carrying a backpack heavier than 10% of one's body weight can cause shallowing of the lumbar lordosis and a tendency towards a vertical position of the sacrum.

Likewise, a study by Mohan et al.[31] revealed that 60.6% of children had musculoskeletal problems attributed to heavy backpacks, 55.02% of whom were males and 66.53% of whom were females. The probability of encountering these issues increased with a greater proportionate weight of the backpack, a pattern observed among male and female children. However, a study by Hernández et al.[32] found no significant correlation between the weight or type of backpack and the pressure pain threshold collected from shoulder muscles.

Based on the findings of the studies mentioned, it can be inferred that an increasing number of school-age children are displaying spinal deformities. These detrimental changes have a negative impact on the entire body, underscoring the necessity for suitable interventions to tackle these concerns.

In various studies on spinal deformities, gender features are often explored to determine which gender is more affected by these conditions. In the present study, we revealed that among all the pupils from the three schools involved in the study, girls exhibited higher scores for all deformities (mild scoliosis signs, moderate to severe scoliosis signs, mild kyphosis signs [except SCH2], moderate to severe kyphosis signs, changes in cervical and lumbar lordosis) compared to boys (P<0.05).

Similar to the outcomes of our study, some studies also demonstrated a higher prevalence of these deformities in female subjects than male subjects.[33-36] There is still no specific reason females are more affected by spinal deformities than males. However, gender differences in the prevalence of spinal deformities may result from a combination of anatomical, hormonal, and various physical activities that impact the development and health of the spine in females and males.

Since Kosovo has one of the youngest populations in Europe, treating and preventing this phenomenon requires commitment from the whole society. Our findings can provide policymakers with important information to develop an appropriate program of rational planning, monitoring of pupils, and treatment provision. In Kosovo, schools should develop and implement instructional programs and workshops focused on prevention, proper care, spinal abnormalities, and spinal health. Healthcare educators or licensed physiotherapists can lead these initiatives. Therefore, schools should establish regulations to reduce the weight of children's bags. It is crucial to ensure that parents and schools are informed and actively enforce these regulations. Maintaining and expanding programs to continually bring licensed physical therapists into schools is critical. These initiatives conduct awareness campaigns and presentations focused on spinal health.

Conclusion

Our investigation revealed a significant correlation between the weight of pupils' backpacks, school-home distance, and the prevalence of spinal deformities. Pupils carrying heavier backpacks, exceeding the recommended limit of 10% of their body weight, demonstrated a higher likelihood of exhibiting scoliotic changes, kyphotic changes, and alterations in cervical and lumbar lordosis. Moreover, the increased school-home distance also correlated positively with all assessed spinal deformities. Additionally, our study highlighted gender differences, indicating a higher prevalence of spinal deformities among girls across various categories of deformities.

Overall, the increasing prevalence of spinal deformities among school-age children underscores the urgency for effective interventions.

Addressing the impact of heavy backpacks and considering gender-specific factors in spinal health management are crucial steps toward mitigating these issues and safeguarding the well-being of our younger population. Our findings should address the problems identified in the study and formulate a comprehensive strategy to enhance pupils' understanding of spinal health. These suggestions should be integrated into a more comprehensive plan aimed at improving the standard of living and healthcare for pupils in the Municipality of Peja in Kosovo and neighboring municipalities. The Ministry of Education should promote regular health check-ups for pupils to identify and treat spinal

abnormalities and deformities. It is important to encourage pupils to consult medical specialists if they have concerns about their spinal health. Addressing this issue requires collaboration among local governments, parents, schools, and the wider community. Community support is crucial to reducing backpack weight, implementing transportation improvements, and fostering a supportive environment for children.

Ethical Considerations

This study was approved by the Municipal Directorate of Education of the Municipality of Peja (No 36/10 of 11.15.2022). The participants' information was confidentially protected.

Competing Interests

The author declares that there is no conflict of interest.

Acknowledgments

We thank the Director of Education in the Municipality of Peja, the Parents, the Council, and the team that enabled the work in the field and the finalization of this study.

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