

Research Article

Prevalence of Back Deformities Among Primary School Students

Asim Hatim Mohammed¹, Tareq Abduljalil Hajeb¹, Asim Mamoun Abdelbagi¹, Dafaalla Salih¹, M. Elghazali Abuelgassim E. Mustafa^{1,*} , Mohammed Mubarak Mohammed², Hozifa Mohammed Ali Abd-Elmaged³ 

¹Faculty of Medicine, Alzaiem Alazhari University, Khartoum, Sudan

²Orthopaedic Department, Ibrahiem Malik Teaching Hospital, Khartoum, Sudan

³Orthopaedic Department, Alzaiem Alazhari University, Khartoum, Sudan

Abstract

Background: The high incidence of spinal abnormalities among primary school students is a pressing health issue that demands attention. Recent epidemiological studies have emphasized the importance of spinal anomalies in this specific population. The rising prevalence can be attributed to factors such as sedentary lifestyles, insufficient ergonomic practices, and a lack of awareness. Understanding the extent of these abnormalities is crucial for promptly identifying and intervening since they might affect the general welfare and educational achievement of primary school students. The aim of this study was to estimate the Prevalence of Back Deformities among Primary School Students in Khartoum, Sudan 2022-2023. **Materials and Methods:** This study is an observational, descriptive, cross-sectional community-based study conducted in four government primary schools in the Bahri locality from November 2022 to February 2023 among primary school students. Data was analyzed and interpreted using Statistical Package for the Social Sciences (SPSS) data analysis software version 26.0. **Results:** This study included a total of 383 primary school students in Bahri locality (males: 200 (52.2%) and females: 183 (47.8%). The male-to-female ratio is 1.1:1, with a mean age of 9 years and ranging from 6 to 12 years. The posture wall test and Adam forward bending test were used to diagnose coronal and sagittal deformities. The posture wall test was positive in 3 cases (0.78%). There were 3 cases of kyphosis, 2 males and 1 female. The deformity was in the thoracic region in all cases.

Keywords

Back Deformities, Primary School Students, Spinal Abnormalities, Kyphosis, Scoliosis Epidemiology

1. Introduction

Back deformities among primary school children have become a significant health concern due to their potential impact on physical growth, intellectual performance, and overall quality of life. The spine plays a crucial role in the

musculoskeletal system, and any abnormalities in its structure can lead to deformities. Factors such as sedentary lifestyles, changing habits, and increased dependence on backpacks have contributed to the rising prevalence of these issues.

*Corresponding author: mohd.elghazali@gmail.com (M. Elghazali Abuelgassim E. Mustafa)

Received: 21 April 2024; **Accepted:** 15 May 2024; **Published:** 3 June 2024



Consequently, understanding these abnormalities is essential for developing effective prevention methods, early identification, and implementing programs to improve the health and well-being of this vulnerable group.

Abnormalities in the back are a major concern for primary school children as they can affect their physical growth, intellectual performance, and overall quality of life. The spine, being a crucial component of the musculoskeletal system, can lead to deformities. The prevalence of these issues is on the rise due to sedentary lifestyles, changing habits, and increased dependence on backpacks. It is important to understand these abnormalities to develop effective prevention methods, identify them early, and implement programs to improve the health and well-being of this vulnerable group. [1, 2]

Structural abnormalities that affect the spine are referred to as back deformities. The definition and extent of spinal deformities are constantly evolving. Spinal deformity is a broad term that encompasses various conditions such as idiopathic adolescent scoliosis, congenital scoliosis, post-traumatic deformities, and other forms of adult spinal deformity, such as post-infective kyphosis. Each deformity has its unique characteristics and can lead to different potential consequences. [3].

Scoliosis is a lateral spine curvature, often accompanied by vertebral rotation, with idiopathic scoliosis being the most prevalent type. It is caused by genetic, neuromuscular, hormonal, and connective tissue abnormalities [4, 5]. Genetic markers and inherited characteristics determine vulnerability to this illness, while neuromuscular scoliosis is common in individuals with neurological problems. Hormonal factors, particularly during pubertal growth spurt, may also contribute to scoliosis development. Early identification and intervention are crucial for preventing its progression. [6-8]

A kyphotic back is caused by an excessive forward curvature of the thoracic spine, which makes the back round or slumped. Scheuermann's illness, congenital abnormalities, and structural kyphosis are among the causes. Other factors that may be involved include congenital anomalies, incorrect posture, and Scheuermann's illness. Kyphosis can also result from certain body positions, such as protracted slouching or excessive use of electronics. Kyphotic abnormalities can also be brought on by neuromuscular conditions such as cerebral palsy or muscular dystrophy. [9]

Understanding the diverse factors involved in the causation of scoliosis and kyphosis is crucial for early identification, intervention, and management of these spinal deformities. Kyphosis and scoliosis have a multifactorial etiology, comprising environmental, neuromuscular, and genetic components. Scientists have investigated many facets of these spinal abnormalities in order to understand the intricate interactions that contribute to their formation.

The posture wall test, also known as the spinal alignment wall test, is a non-invasive method used to assess posture variations in the thoracic and lumbar spine regions. It evaluates thoracic kyphosis by measuring the occipital-to-wall

distance (OWD), which indicates proper alignment. The test also helps in determining lumbar lordosis by observing the gap between the lower back and the wall, which can indicate normal or hyperlordosis.

The Adams Forward Bend Test is a clinical evaluation used by orthopedic specialists to detect spine deformities, particularly scoliosis. The test involves the person standing barefoot, leaning forward, and the examiner observing their spinal curvature. The primary goal is to identify signs of spine abnormalities. [10]

The primary aim of the research is to estimate the prevalence of back deformities among primary school students in a specific locality, in this case, Bahri locality in Khartoum, Sudan, during the period of 2022-2023. The researchers sought to conduct an observational, descriptive, cross-sectional community-based study to gather data on the prevalence of back deformities and to analyze and interpret the findings.

The significance of the problem lies in its potential impact on the health and well-being of primary school children. Back deformities can affect various aspects of a child's life, including physical health, academic performance, and psychological well-being. Addressing this issue is crucial for promoting the overall development and quality of life of primary school students. Moreover, by understanding the prevalence and characteristics of back deformities, healthcare professionals, educators, and policymakers can develop targeted interventions and strategies to prevent, identify, and manage these conditions effectively.

The research question guiding this study is What is the prevalence of back deformities among primary school students in Bahri locality, Khartoum, Sudan, during the period of 2022-2023? By answering this question, the researchers aim to provide valuable insights into the extent of the problem and inform future efforts aimed at addressing back deformities among primary school children.

2. Material and Methods

This study is a descriptive, observational, cross-sectional community-based study, conducted in Khartoum state, which is the capital of Sudan and contains three main localities, and it contains a total of 1962 primary schools. The study was conducted in four primary governmental schools which have been chosen on a random basis within the period from November 2022 to February 2023.

The study population are primary school students of both genders, who live in the Bahri locality, and study in the governmental schools within the locality, students aged between 6 and 14 years and studying in primary schools in Khartoum state in 2022-2023 was included. Students of High schools, Students outside Khartoum, & Students with other musculoskeletal deformities was excluded from the study.

A comprehensive random sample of 383 elementary school students, consisting of 200 boys and 183 girls, aged between 6

and 12 years were selected. A multistage random sampling procedure was employed to choose the sample. Initially, Bahri city was selected at random from the three cities in Khartoum state, Sudan. Following that, the Bahri locality was selected randomly from the two Bahri localities. Then 4 Primary governmental schools were chosen (2 male and 2 female) using a stratified random technique from a list of Primary schools which was obtained through the Directorate of Education in the Bahri locality. Then, within the school, students were chosen at random from a list obtained from the school's headmaster.

Data was collected using a structural questionnaire sheet which consists of two parts. The first part is sociodemographic data of each individual such as age and gender and the second part data regarding the specific attributes of the deformity was collected by employing closed-ended questions. These questions focused on the student's perception of the deformity, the type and severity of the deformity, and any accompanying factors such as pain.

The researchers administered the questionnaire through direct interviews with students during their activity hours. Each class was assessed separately. The students were provided with a thorough explanation of the study's objectives and procedure, as well as statements assuring them that their responses would be kept confidential and used solely for research purposes.

Under the supervision of the class headmaster, students were individually instructed to remove their shirts for a thorough examination. The examination focused on identifying any shoulder asymmetry, prominence of the scapula, uneven waistline or arm span, and any abnormalities related to the trunk or spine, such as rib humps or issues in the lumbar region.

Adam's forward bending test was employed to evaluate any abnormalities in the coronal plane. The Posture wall test was utilized for the identification of sagittal abnormalities. The duration of this process was around 1 minute per student.

The classification of study variables is presented in (Table 1).

The data was inputted, processed, and analyzed using SPSS version 26.0. Descriptive statistics are represented using frequency tables, which include percentages and graphs. Means and standard deviations are presented with relevant graphical representations for quantitative data. A p-value equal to or less than 0.005 is deemed to be statistically significant.

Following analysis, data was presented in the form of uni-variable tables, cross-tabulation (bi-variable tables), and narrative illustration.

Table 1. Study variables.

Dependent	Independent
Adams forward bend test	Age Gender
Back deformity	Back pain
Side of deformity	Noticing back deformity

Dependent	Independent
Curvature degree	

3. Ethical Consideration

Written ethical clearance and sanctions from both Alzaiem Alazhari University and the Ministry of Education were obtained to conduct this research.

Administrative authorities of selected institutions were consulted for written consent.

The study data and information were utilized exclusively for research objectives, with careful consideration given to privacy concerns.

4. Result

The study thoroughly examined the selected sample, consisting of three hundred and eighty-three elementary school students. The students had an average age of 9 years, ranging from 6 to 12 years. (Tables 1 and 2). Of these students, two hundred (52.2%) were males, and one hundred and eighty-three were females (47.78%).

Adams forward bending test was employed for screening purposes to identify coronal deformities. The test turned out to be negative in all cases. Posture wall test was used for screening of sagittal deformities. This test yielded positive results in three students, accounting for 0.8% of the total sample size. Three instances of kyphosis were discovered, with a prevalence rate of 0.78%. No instances of scoliosis were reported. Two students noticed their back deformity.

Table 2. Distribution of the participants according to age groups.

Age	Frequency	Percent
6-8 years	146	38.10%
9-12 years	234	61.10%
>12 years	3	0.80%
Total	383	100%

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Dev.
Age	383	6.00	17.00	9.0209	1.87001

The majority of the students between 9-12 years old.

Regarding the back deformities, two cases (66.7%) being male students, and one case (33.3%) being a female student

(Table 3). The deformities observed were all kyphosis 3 (100%). The thoracic region was affected in all three cases, (100%) (Figure 1). The degree of curvature was mild in one instance, accounting for (33.3%) of the cases, while the remaining two cases displayed a moderate degree of curvature, accounting for (66.7%). Six of the students reported experiencing back pain.

There was no discernible disparity between the cases and the regular students. Nevertheless, the incidence of back abnormalities was greater in boys, with a rate of 1% compared to 0.5% in girls.

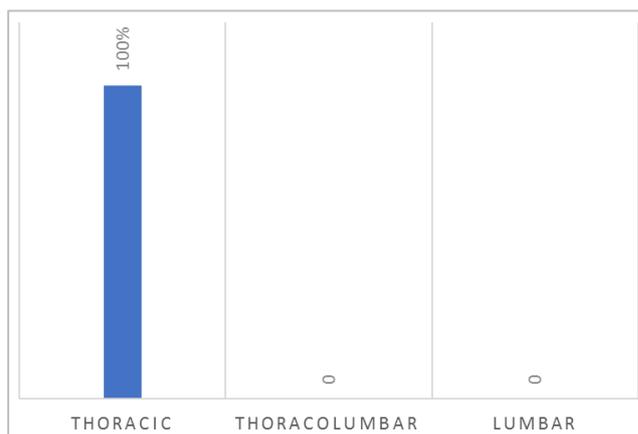


Figure 1. Region of the curve among the students with back deformities. (n=3).

Table 3. Cases of back deformities among primary school students in Bahri locality (n=3).

Age	Gender	Noticed	Wall test	Adam forward bending test	Type of deformity	Region	Back pain
17	Female	Yes	Positive	Negative	Kyphosis	Thoracic	Yes
11	Male	Yes	Positive	Negative	Kyphosis	Thoracic	Yes
12	Male	Yes	Positive	Negative	Kyphosis	Thoracic	No

5. Discussion

Back deformities are common among school-aged children, and addressing this issue requires a holistic approach involving healthcare professionals, educators, parents, and policymakers. Early detection, awareness campaigns, ergonomic adjustments in school environments, and promoting healthy lifestyles are essential components of efforts to mitigate the impact of these deformities on the well-being of primary school students.

The prevalence rate of (%0.78) that was discovered in this study is in line with previous research conducted by Ropac D et al [11], highlighting the consistent nature of this issue. The elevated prevalence of spinal abnormalities suggests the involvement of multiple factors, such as sedentary lifestyle, excessive use of electronic devices, and lack of ergonomic awareness.

This study utilized the Posture wall test and Adams forward test for screening purposes, which identified a prevalence of back abnormalities of 0.78%. The incidence of back abnormalities, particularly kyphosis, is lower compared to the findings published by Jorgic Bojan et al [12]. Which was 6.9%, and the prevalence indicated in the systemic review conducted by Taleschian et al [13], Which was 13.06%. Suggesting that the prevalence of back abnormalities in Sudan

is underestimated.

There was a prevalence of 0.78% for observed back deformities, which exclusively consisted of kyphosis. This affected the thoracic region in all cases, meaning 100% of the affected students. This is a higher percentage compared to the 32.2% reported by Robert Rusnak et. al [14], which only included thoracic region involvement.

The incidence of back deformities was higher in males (66.7%) than in females (33.3%), which is consistent with the findings of Ropac D et al [11]. Their study showed that there was a higher prevalence of kyphosis in males, especially among lower-grade students. However, the percentage of affected females significantly increased among older students.

Comparative assessments of existing literature highlight the necessity of implementing focused interventions in primary school environments. Our findings support the need for better awareness campaigns, the adoption of ergonomic techniques, and the inclusion of regular spinal screenings in school health programs. This study provides valuable insights into the frequency of spinal abnormalities among primary school students. However, it is important to acknowledge the various limitations faced during the study, including difficulties in acquiring approvals, unavailability of specific tools like Scoliometer for identifying and measuring the degree of coronal deformities, and rejection of cooperation by some

school headmasters.

Kellis et al [15] studied that teenagers with idiopathic scoliosis have their spine curvature using the flexicurve measured for reliability. It assesses the precision and reliability of this measurement instrument, offering information about its applicability to physicians in tracking patients with scoliosis.

Future studies should address these limitations to enhance our understanding of this pressing health concern. Additionally, the study should have recognized certain risk factors, like sedentary lifestyles and heavy backpacks, to emphasize the significance of implementing tailored preventative interventions. Such interventions may include instructions on proper body alignment, promoting physical exercise, and enhancing educational curricula in schools.

To summarize, this study adds vital information to the conversation on primary school pupils' spinal health. The prevalence rates discovered call for cooperation between educators, medical professionals, and legislators to put preventative measures in place to reduce the negative effects of back abnormalities on the health of the younger population.

6. Conclusion

The research article focused on estimating the prevalence of back deformities among primary school students in Khartoum, Sudan, during the period of 2022-2023. The study employed observational, descriptive, cross-sectional community-based methods to gather data on the prevalence of back deformities using the Posture wall test and Adams forward bending test.

The findings revealed a prevalence rate of 0.78% for back deformities among primary school students, with all cases being kyphosis affecting the thoracic region. This prevalence is lower compared to some previous studies, suggesting a potential underestimation of back abnormalities in Sudan. The study also noted a higher incidence of back deformities in males compared to females.

The research underscores the importance of early detection, awareness campaigns, ergonomic adjustments in school environments, and promoting healthy lifestyles to mitigate the impact of back deformities on the well-being of primary school students. However, the study faced limitations such as difficulties in acquiring approvals and the unavailability of specific tools for identifying and measuring the degree of coronal deformities.

For future research, it is recommended to address these limitations and recognize additional risk factors such as sedentary lifestyles and heavy backpacks. Furthermore, future studies could explore the effectiveness of tailored preventative interventions, including instructions on proper body alignment, promotion of physical exercise, and enhancement of educational curricula in schools. Additionally, longitudinal studies could provide insights into the long-term effects of back deformities on the health and well-being of primary school students.

Abbreviations

SPSS	Statistical Package for the Social Sciences
OWD	Occipital-to-Wall Distance
Std. Dev	Standard Deviation

Author Contributions

Asim Hatim Mohammed: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Visualization, Writing – original draft

Tareq Abduljalil Hajeb: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Visualization, Writing – original draft

Asim Mamoun Abdelbagi: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Software, Visualization, Writing – original draft

Dafaalla Salih: Conceptualization, Methodology, Writing – original draft, Writing – review & editing

M. Elghazali Abuelgassim E. Mustafa: Methodology, Supervision, Project administration, Writing – original draft, Writing – review & editing

Mohammed Mubarak Mohammed: Conceptualization, Data curation, Formal Analysis, Methodology, Project administration, Resources, Supervision, Writing – original draft

Hozifa Mohammed Ali Abd-Elmaged: Conceptualization, Methodology, Project administration, Resources, Supervision, Validation, Writing – original draft

Data Availability Statement

Data available on request from authors.

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Mitova, Stamenka & Popova, Daniela & Gramatikova, Mariya. (2014). Postural Disorders and Spinal Deformities in Children at Primary School Age. System for Screening, Examination, Prevention and Treatment. 4. 172-177.
- [2] Apostolia, Dimaki & Hristara-Papadopoulou, A & Ilias, Kallistratos & Georgios, Tsigaras & Trevlaki, Evgenia & Athanasios, Kirkousis. (2020). Screening for asymmetries in upright posture using the posture screen mobile application in adolescence: Potential factors of postural disorder and asymmetries. International Journal of Hygiene and Environmental Health. 7. 105-110. <https://doi.org/10.15739/irjpeh.20.015>
- [3] Moon MS, Lee BJ, Kim SS. Spinal deformity. Indian Journal of Orthopaedics. 2010 Apr; 44(2): 123. <https://doi.org/10.4103/0019-5413.61725>

- [4] Weinstein SL, Dolan LA, Cheng JC, Danielsson A, Morcuende JA. Adolescent idiopathic scoliosis. *The Lancet*. 2008; 371(9623): 1527–37. [https://doi.org/10.1016/s0140-6736\(08\)60658-3](https://doi.org/10.1016/s0140-6736(08)60658-3)
- [5] Halawi MJ, Lark RK, Fitch RD. Neuromuscular scoliosis: Current concepts. *Orthopedics*. 2015; 38(6). <https://doi.org/10.3928/01477447-20150603-50>
- [6] Skogland LB, Miller JA. Growth related hormones in idiopathic scoliosis: an endocrine basis for accelerated growth. *Acta Orthopaedica Scandinavica*. 1980; 51(1–6): 779–89. <https://doi.org/10.3109/17453678008990874>
- [7] Pollock L, Ridout A, Teh J, Nnadi C, Stavroulias D, Pitcher A, et al. The musculoskeletal manifestations of Marfan syndrome: Diagnosis, impact, and Management. *Current Rheumatology Reports*. 2021; 23(11). <https://doi.org/10.1007/s11926-021-01045-3>
- [8] Natarajan D, Samartzis D, Wong Y-W, Luk KDK, Cheung KMC. Natural history of spinal deformity in a patient with Ehlers-Danlos Syndrome: Case report with 20-year follow-up. *The Spine Journal*. 2011; 11(7). <https://doi.org/10.1016/j.spinee.2011.02.029>
- [9] Lam JC, Mukhdomi T. Kyphosis. [Updated 2023 Aug 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK558945/>
- [10] Physiopedia contributors. Adam’s Forward Bend Test [Internet]. Physiopedia; 2023 [cited 2023 Dec 13]. Available from: https://www.physio-pedia.com/Adam%27s_forward_bend_test
- [11] Ropac D, Stašević I, Samardžić D, Mijaković Ž. Spinal deformities among pupils—a growing issue. *Collegium antropologicum*. 2013 May 23; 37(2): 139-45.
- [12] Jorgić B, Đorđević S, Milenković S, Stanković R. The prevalence of postural disorders among eighth grade elementary school students. *Fizičko vaspitanje i sport kroz vekove*. 2020; 7(1): 83-93. <https://doi.org/10.2478/spes-2020-0007>
- [13] Taleschian-Tabrizi N, Alinezhad F, Pezeshki MZ, Dastgiri S, Ekharsadat B, Dolatkah N. Prevalence of Spinal Deformities among School Age Children in Iran: A Systematic Review and Meta-Analysis. *Int J Pediatr* 2022; 10(7): 16402-16416. <https://doi.org/10.22038/ijp.2022.65750.4960>
- [14] Rusnák R, Kolarová M, Aštaryová I, Kutiš P. Screening and early identification of spinal deformities and posture in 311 children: results from 16 districts in Slovakia. *Rehabilitation Research and Practice*. 2019 Mar 17; 2019. <https://doi.org/10.1155/2019/4758386>
- [15] Kellis, E., Adamou, G., Tzilios, G., & Emmanouilidou, M. (2008). Reliability of spinal curvature assessment with the flexicurve for adolescents with idiopathic scoliosis. *Studies in Health Technology and Informatics*, 140, 179-182. <https://doi.org/10.3233/978-1-58603-864-9-179>.