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Comparison of spinal deformities among the male students of private and government schools

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Abstract

Objective: The study aimed to compare spinal deformities among male students of private and government schools in Chandigarh.

Method: A total of four hundred (N=400) male school students of Chandigarh, consisting of two hundred (n=200) from private schools and two hundred (n=200) from government schools. The male students were selected by using a convenient sampling technique. The subject's age ranged between 13 to 17 years. Flex curve and sociometer were used to measure the spinal deformities (thoracic kyphosis, lumber lordosis and scoliosis). Descriptive statistics and t-test were employed to analyze the data. The level of significance was set at 0.05.

Result: The result of the study showed that overall, 44.25% of school students in Chandigarh suffered from spinal deformities. Thoracic kyphosis was high in students of private schools whereas lumber lordosis was more prevalent in government schools. Scoliosis was reported in equal numbers of students in private and government schools. A significant difference was found in the degree of flexion in the thoracic region (kyphosis) of the spine between government and private school students.

Conclusion: The incidence of thoracic kyphosis might be related to the school type as in the present study thoracic kyphosis was reported to be high among the students of private schools.

Keywords: Spinal deformities, thoracic kyphosis, lumber lordosis, scoliosis

Introduction

Posture is a state that enables the body to function optimally in terms of work efficiency, health, and appearance. It is not merely a matter of static positioning but rather the result of efficient actions (Morrison & Chenoweth, 1955) ^[1]. The body's posture plays a crucial role in the optimal functioning of the human physique. Establishing correct postural habits during early childhood not only promotes proper growth and development but also has lasting positive effects on overall well-being and quality of life in the future (Gao *et al.*, 2018) ^[5].

Functionally, the spine supports the trunk, head, and upper extremities. It also encloses and protects the spinal cord and the nerves branching from it. The intervertebral discs and the flexibility of the spine enable the absorption of shocks and impacts experienced during various human activities, even mild ones such as walking. The flexibility and strength of the spine safeguard it and facilitate the wide range of movements necessary and desirable in modern life. Although the movement between individual vertebrae is limited, the cumulative movement across all vertebrae allows for significant flexion, extension, abduction, adduction, rotation, and circumduction (Arnold, 1923) ^[2]. A postural "slump" often indicates fatigue or poor physical condition and may serve as a barometer of muscle tone (Cureton, 1947) ^[4]. Postural defects vary in type and severity, ranging from mild to severe. While some primarily affect the lower extremities, others involve the spine. The most common spinal postural defects are thoracic kyphosis, lumbar lordosis, and scoliosis.

Kyphosis is an abnormal exaggeration of the normal anterior-posterior (concave) curve in the dorsal region of the spine. When the curve in this region becomes excessively pronounced over time, the anterior portions of the vertebrae tend to become wedge-shaped. Conversely,

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lordosis involves an exaggerated hyperextension of the lumbar spine. This condition is often associated with tightness in the lower erector spinae, iliopsoas, and rectus femoris muscle groups, combined with weakened or overstretched abdominal muscles (Morton *et al.*, 1952)^[12].

Scoliosis is a roto-lateral curvature of the spine, characterized by a consistent deviation of a series of vertebral spinous processes from the median line of the body. There are two types of scoliosis: postural (or functional) and structural. Functional scoliosis is a muscular condition that, although not initially serious, can persist and progress into a structural or fixed curvature if left untreated. In structural scoliosis, the curvature does not disappear when the individual is lying down (Lovett, 1924)^[9].

In recent decades, there has been a notable increase in the prevalence of postural deformities, particularly among adolescents. These deformities can adversely affect the functional efficiency and academic performance of students compared to their peers with normal posture. Early detection is crucial, as many postural abnormalities can be corrected or mitigated if identified in a timely manner. Therefore, this study was designed to detect postural deformities among school students in the Union Territory of Chandigarh. It specifically aimed to examine spinal postural deformities, including thoracic kyphosis, lumbar lordosis, and scoliosis, among students from both private and government schools in Chandigarh.

Materials and Methods

Design of the Study

A cross-sectional survey-type study has been designed to accomplish the study's objectives.

Selection of Subjects

The students were selected from private and government schools in Chandigarh. A total of four hundred male (N=400) school students including two hundred (n=200) from private schools and two hundred (n=200) from government schools were selected for the study using a convenient sampling technique. The age of the subjects ranged between 13 to 17 years. The permission to collect data was obtained from the District Education Officer of Chandigarh and the school principals. Before the collection of data, the objectives of the study were explained to the selected students. The data was collected from the students who volunteered for the study.

Kyphosis and Lordosis

The flex curve method, a non-invasive technique, was utilized to measure the angles of thoracic and lumbar curves of the spine. This method employs a flexible ruler, a 60 cm strip of

lead covered with plastic, which can be bent in one plane and retains its shape. To measure spinal curvature, the flexible ruler is moulded along the mid-line contour of the spine between two marked points. It is then placed on a piece of paper, and the spinal curvature is copied by tracing along the ruler with a pencil. The obtained spine contour is carefully traced onto the paper by the tester. The flex curve determines the degree of thoracic kyphosis and lumbar lordosis using the equation $\theta = 4 * \text{Arctan}(2H/L)$ to convert collected data to degrees. Thoracic kyphosis deformity is considered if flexion in the thoracic spine is more than 42°, while an increase in lumbar curve exceeding 32.2° is considered lumbar lordosis.

Scoliosis

The Adam's Forward Bend test is utilized to measure the lateral curvature of the spine. During the test, the subject assumes a normal standing position and gradually bends the head forward, continuing with the trunk until the hands reach approximately to the toes. A sociometer is used to measure the degree of scoliosis, with a reading of more than 5 degrees indicating the presence of scoliosis deformity in the spine.

Statistical Analysis

Descriptive statistics were applied to analyze the data. The independent t-test was employed to find the difference among the students of private and government schools on thoracic kyphosis, lumber lordosis and scoliosis with the help of SPSS software version 21. The level of significance was set at 0.05.

Results

Table 1: Prevalence of thoracic kyphosis, lumber lordosis, and scoliosis in male students of private and government schools of Chandigarh

Variables	Private		Government		Total	
	Number	%	Number	%	F	%
Thoracic Kyphosis	39	19.5	15	7.5	54	13.5
Lumber lordosis	31	15.5	43	21.5	74	18.5
Scoliosis	25	12.5	24	12	49	12.25
Normal spine	105	52.5	118	59	223	55.75
Total	200	100	200	100	400	100

It is evident from Table 1 that the prevalence of thoracic kyphosis and scoliosis was higher in private school students than in government school students. However, the lumber lordosis was reported to be high among the students studying in government schools. The result of the study also shows that in total, 44.25% of the students of Chandigarh suffered from spinal deformities.

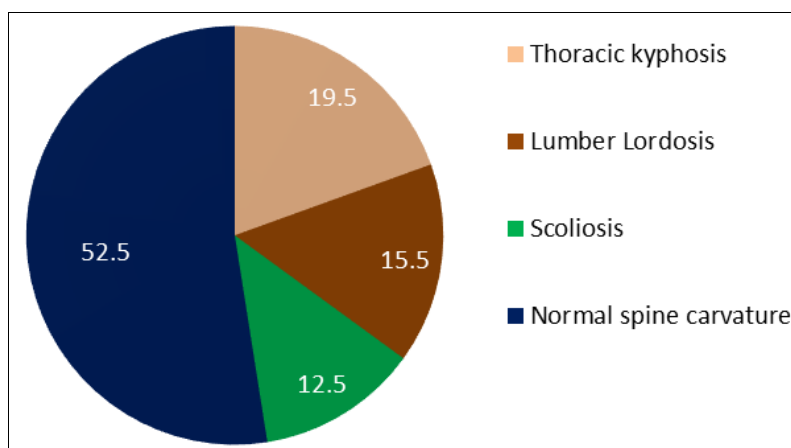


Fig 1: Prevalence of thoracic kyphosis, lumbar lordosis, and scoliosis deformities in male students of private schools in Chandigarh

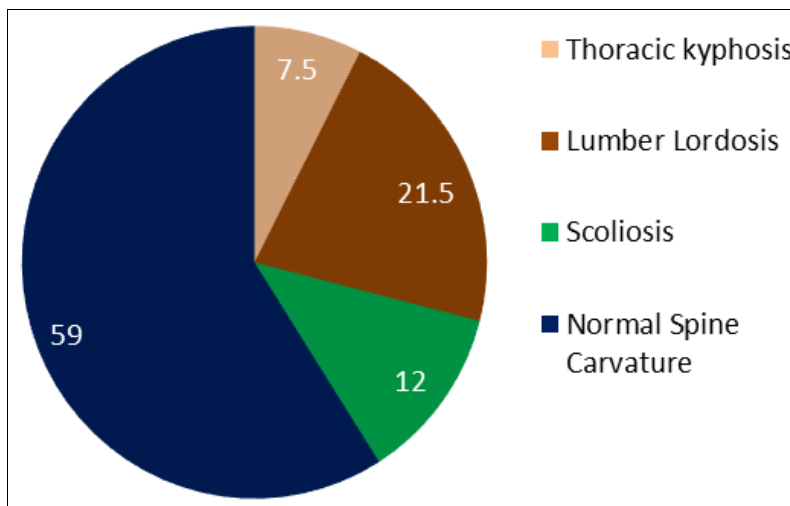


Fig 2: Prevalence of thoracic kyphosis, lumber lordosis and scoliosis deformities in male Students of government schools in Chandigarh

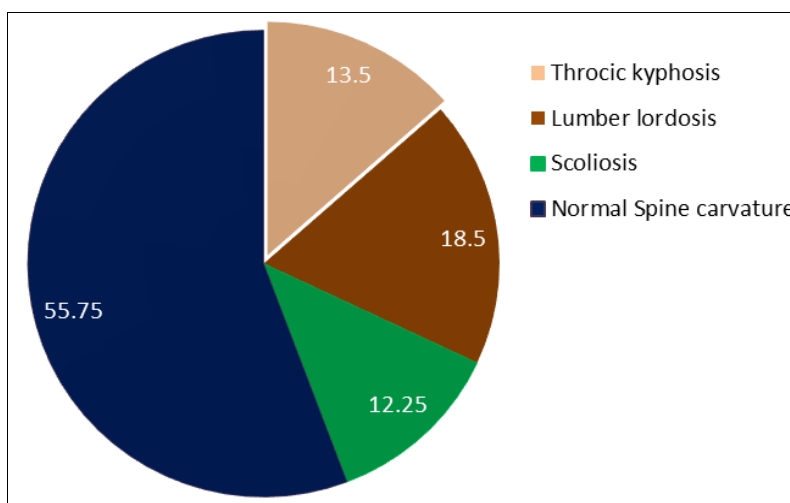


Fig 3: Prevalence of thoracic kyphosis, lumber lordosis and scoliosis deformities in male school students of the Chandigarh

Table 2: Comparison of spinal deformities among male students of private and government schools in Chandigarh

Variables	Private school	Government School	t- value	Sig
	Mean (SD)	Mean (SD)		
Thoracic kyphosis (flexion in thoracic region-degree)	33.8 (8.41)	29.18 (6.47)	3.190	0.01
Lumbar Lordosis (flexion of the lumbar region- degree)	27.16 (5.17)	28.27 (3.90)	1.84	.445
Scoliosis (lateral curvature-degree)	3.19 (1.79)	3.32 (1.92)	.547	.520

The results indicated that the degree of flexion in the thoracic region (kyphosis) of the spine was significantly higher ($t=3.190, p=0.01$) in private school students as compared to government school students. However, no significant

difference was found in the flexion of the lumbar and lateral curvature of the spine between the private and government school students of Chandigarh.

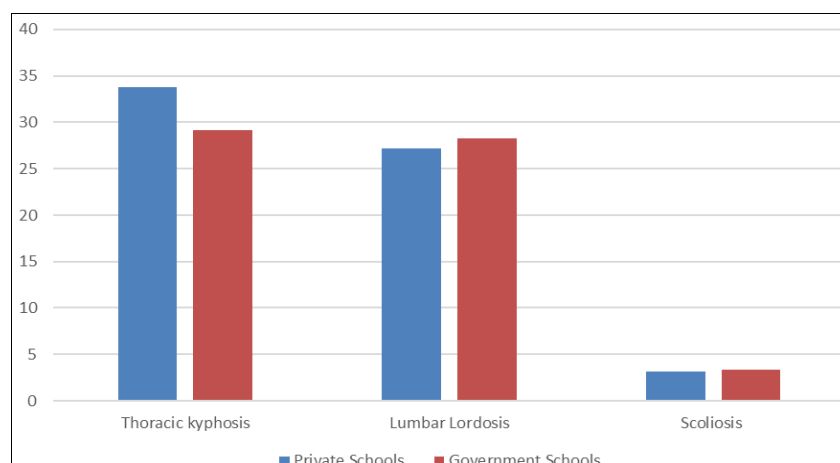


Fig 4: Comparison of thoracic kyphosis, lumber lordosis and scoliosis deformities among the male students of private and government schools of Chandigarh

Discussion

The result of the study indicated that 44.5 percent of students in Chandigarh suffered from spinal deformities including thoracic kyphosis reported in 13.5 percent of students, lumber lordosis in 18.5 percent, and scoliosis in 12.15 percent of students. Thoracic kyphosis was high in students of private schools whereas lumber lordosis was more prevalent in government schools. Scoliosis was reported in equal numbers of students in private and government schools. Rasool *et al.* (2024) ^[16] concluded that in the state of Jammu and Kashmir, spinal deformities such as kyphosis, lordosis and scoliosis were reported in 5.2, 2.05 and 0.6 percent of school students respectively. Similarly, another study on Iranian school children reported the prevalence of kyphosis in 13.06%, lordosis in 32.59% and scoliosis in 2.61% of the school students (Taleschian-Tabrizi *et al.*, 2022) ^[21]. Li *et al.* (2024) ^[8] conducted a meta-analysis on school children, the result shows that scoliosis prevailed among 3.1% of students and BMI, age, gender, race, environmental factors, and lifestyles were the predictable factors for the prevalence of scoliosis. Scoliosis was also reported among 24.3% of school students in Santos, Brazil (Ciaccia *et al.*, 2017) ^[3] and 3.9% in Zhejiang Province, China (Zou *et al.*, 2022). In the case of kyphosis, it was reported in 21.4% of Iranian school students (Ghorbani *et al.*, 2010) ^[6], 12% of girls and 15.3% of boys in Bochum, German (Nitzschke & Hildenbrand, 1990) ^[14] and 58% of school students in Madhya Pradesh, India (Sharma & Singh, 2018a) ^[19]. The lordosis was reported among 43% of school students in students in Madhya Pradesh, India (Sharma & Singh, 2018b) ^[20] and 38.46% of children in Kermanshah, Iran (Pirani *et al.*, 2017) ^[15].

The study results show that the mean value of flexion in the thoracic region (kyphosis) was significantly higher among the students in private schools than in government schools. The difference in the mean value of flexion of the lumbar region (lordosis) and lateral curvature (scoliosis) was statistically insignificant. The result of the present study is in line with a study conducted by Ahmad *et al.*, (2024) ^[1] who also testified a high rate of postural deformities among the students of private schools as compared to the government schools. However, in the Iranian school students, the spinal deformities were more prevalent in public schools (Mosavi *et al.*, 2015) ^[13]. In Egyptian girls, postural defects were also more prominent in public schools than in private schools (Saeed *et al.*, 2022) ^[17]. The higher incidence of thoracic kyphosis in private school students may be attributed to insufficient physical activity, unhealthy eating habits and higher screen time (Jung *et al.*, 2016; Mahaur & Badiger, 2018; Sarvari *et al.*, 2022) ^[7, 10, 18]. Indulgence in more academic activities, that require more sedentary sitting, may also be one of the factors for a high rate of kyphosis among private school students.

Conclusions

It can be concluded that the incidence of thoracic kyphosis might be related to the school type as in the present study thoracic kyphosis was reported to be high among the students of private schools. Comprehensive school health programs should be implemented meticulously to detect and prevent postural deformities among school children. An extensive physical activity program should be interwoven into school activities, including appropriate stretching and strengthening exercises.

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