

Prevalence of Scoliosis in the Adolescent Junior High School Students

Adolesan Ortaokul Öğrencilerinde Skolyoz Prevalansı

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ABSTRACT

Background/aim: This study aimed to evaluate the prevalence of scoliosis in adolescent middle school students in Siva's province and to investigate the necessity of early screening.

Materials and methods: To determine the prevalence of scoliosis, 12 junior high schools in Sivas Province were selected by using the clustering sampling method. In these schools, a total of 557 students aged between 9-15 and who received education in 5th and 8th grade were evaluated. Adam's Forward Bend Test and scoliometer were used.

Results: As a conclusion of scoliosis screening, preliminary scoliosis was diagnosed with a total of 31 students, 14 girls and 17 boy students. 233 of the scoliotic curvatures were right-sided, 114 were left-sided and 3 were bilateral. Spine levels where scoliosis was found were 49.6% thoracic, 12.6% thoracic-lumbar, and 0.9% lumbar levels. Rotational Degree of curvature was found at 7 degrees 2.9%, 8 degrees 1.6%, 9 degrees 0.4% and 10 degrees 0.7%. The incidence of scoliosis was found to be 8.8% in those carrying a school bag on one shoulder and 41.3% in students who spent a long time at a desk.

Conclusions: As a result of our study, we believe that the prevalence of the scoliotic curvature will be reduced by the teaching of correct posture and exercises.

Keywords: Scoliosis, Adolescent, Prevalence

INTRODUCTION

Adolescent idiopathic scoliosis is scoliosis, which can be observed from ten years of age until the completion of spinal column development and is characterized by a lateral curvature of the spine over 10 degrees. It is seen in approximately 2.5% of the population (1). The etiology of idiopathic scoliosis is unknown. However, many related factors are mentioned in the literature. Genetic factors, Neurophysiological factors,

ÖZ

Amaç: Bu çalışmada, Sivas ilinde ergenlik çağındaki ortaokul öğrencilerinde skolyoz prevalansının değerlendirilmesi ve erken taramanın gerekliliğinin araştırılması amaçlandı.

Gereç ve yöntem: Skolyoz prevalansını belirlemek amacıyla, kümeleme örnekleme yöntemi kullanılarak Sivas ilindeki 12 ortaokul seçildi. Bu okullarda 5. ve 8. sınıfta eğitim gören, yaşları 9-15 arasında değişen toplam 557 öğrenci değerlendirmeye alındı. Adam's Öne Eğilme Testi ve skolyometre kullanıldı.

Bulgular: Skolyoz taraması sonucunda 14'ü kız ve 17'si erkek olmak üzere toplam 31 öğrenciye skolyoz ön tanısı konuldu. Skolyotik eğriliklerin 233'ü sağ taraftı, 114'ü sol taraftı ve 3'ü çift taraftıydı. Skolyozun saptandığı omurga seviyeleri %49.6 torakal, %12.6 torakal-lomber ve %0.9 lomber seviyedeydi. Dönme eğriliği derecesi 7 derece %2.9, 8 derece %1.6, 9 derece %0.4 ve 10 derece %0.7 bulundu. Tek omuzda okul çantası taşıyanlarda skolyoz görülme sıklığı %8,8, masa başında uzun süre vakit geçiren öğrencilerin %41,3'ünde saptanmıştır.

Sonuç: Çalışmamız sonucunda doğru duruş ve egzersizlerin öğretilmesiyle skolyotik eğrilik görülme sıklığının azaltılacağına inanıyoruz.

Anahtar Kelimeler: Skolyoz, Adolesan, Prevalans

and histological factors are significant factors amongst others (2,3). In adulthood, some have a stable curve. Others have a more progressive curve, with chronic pain, osteoporosis/fractures, and declines in pulmonary and functional capacity (4). Some complications may occur in its surgery. The complication rate is highest in neuromuscular scoliosis (17.9%), followed by congenital scoliosis (10.6%) and idiopathic scoliosis (6.3%). Neuromuscular scoliosis and congenital scoliosis have the highest mortality rates (0.3% each), followed by idiopathic scoliosis (0.02%) (5). According to research, adolescents with scoliosis may be more likely to develop psychological problems than those with adult scoliosis. For this

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Gönderim Tarihi:20.02.24 - Kabul Tarihi: 12.04.2025

reason, adolescents with scoliosis are treated with a holistic care model, where their psychosocial needs are addressed in addition to physical therapy and rehabilitation (6).

Early diagnosis of scoliosis is very important. It is more common in individuals, especially in secondary education and it is possible to be treated with early diagnosis. Since the decrease in the chance of treatment is due to an increase in the angle of existing scoliosis and an increase in cardiopulmonary issues occurring in case of a delay in diagnosis, early diagnosis of scoliosis becomes an important matter (7,8). Routine scoliosis screening should be continued from infancy to adolescence until the completion of an individual's skeletal development. The Scoliosis Research Society (SRS) recommends screening for children aged between 10 and 14 years and the American Academy of Orthopedic Surgeons (AAOS) for females aged between 11 and 13 years and for males aged between 13 and 14 years (9). American Academy of Pediatrics recommends that the screening of the skeletal system in routine health screening for individuals aged 10-12, 14-16 years (8). In some states in the United States, scoliosis screening is mandatory by law. In 1989, 15 states entailed screening under the law and administrative arrangements for screening were introduced in 5 states. Voluntary screening programs were established in 31 states (4). In the literature, the prevalence varies between 0.13% and 16% of scoliosis screening studies carried out in different countries (7,8,10,11).

In the literature review, it was seen that there were studies that looked at the prevalence of scoliosis with school screenings in our country. Various objective and subjective methods were used in these studies. Generally, Adams Forward Bend Test, palpation, and radiographic methods are preferred. However, there have not been many studies on the scoliometer, which is mentioned as a convenient, fast, and easy method for school screenings in literature. Since the scoliometer will save time during the application, it will also ensure that more students can be reached. As a result of the school screening with the scoliometer, we will be able to find out which student needs an

additional evaluation with radiography. For these reasons, in our study, we will try to reach more students in school scans, evaluate the direction of scoliotic curvature, the degree, and region of truncal rotation in a short time, and show the necessity of its use in school scans, unlike other studies, by using the scoliometer, which is an objective method in the literature (2, 7, 8, 9).

MATERIAL AND METHODS

The research was conducted on 5-8th-grade junior high school students attending schools under the National Education Directorate of Sivas Province.

In this study, there are 55 secondary schools taken from Sivas's province. A total of 42 junior high schools with fewer than 500 students constitute the study population. The total number of students in these junior high schools is 12.000 and the number of female students is 5.773 and the number of male students is 6.227. It was found appropriate to include 12 schools amongst 42 schools by the clustering sampling method.

Ethics committee permission was obtained before the study from the Sivas Cumhuriyet University Non-Interventional Clinical Research Ethics Committee (Decision No: 2018-01/36), required permits Governorate of Sivas and the National Education Directorate, and the school administration, teachers, and students were informed before the screening. A total of 557 students (240 males, 317 females) who have provided informed consent forms were included in the study. We determined the data regarding the use of student bags and the time spent at the desk using the description form we created.

Scoliometer (Baseline, New York, U.S.A), Sociodemographic Form, and Adam's Forward Bending Test were used for data collection.

Adam's Forward Bending Test: Students were asked to bend forward in a manner to make an angle of 90 degrees from the hip and dangle their arms downwards and scapulas were observed from behind students. It was checked whether there is a level difference between the scapulas and noted if it existed.

Scoliometer: Students were asked to bend forward in a manner to make an angle of 90 degrees from the hip and dangle their arms downwards and it was evaluated by moving the scoliometer from the neck through the spine. The results were noted in degrees. A rotational curvature of 10 degrees or more was considered as a referral criterion to the physician. During the evaluation, students were stripped of their clothes. The evaluation was conducted in a private room with the consent of the student and parent.

Figure1. Scoliometer

The scoliosis curvature of the students was measured with a scoliometer.

Sociodemographic Form: It is a form that includes the demographic information of the students and includes general information such as age, height, weight, body mass index, chronic disease.

The data of our study were analyzed with SPSS (version 22.0) computer software. Descriptive statistical techniques, percentage, mean, and standard deviation values were used to determine the mean values of all the data obtained in the study.

RESULTS

In this study, a total of 557 students in 9-15 age groups were screened in 12 different schools. 240 of them were male and 317 were female. The mean age of male students was 12.18 ± 1.29 years (10-15 years), and the mean age of female students was 11.95 ± 1.23 years (10-15 years) (Table 1). The highest number of students in the school screenings was 6th-grade students with 35.5% ($n = 198$) and the lowest number was 7th graders with 17.6% ($n = 98$).

Table 1. Demographic information of the research groups (Sivas, 2018)

	Gender	N	Mean $\pm$ SD
Weight (kg)	Boy	240	44.03 $\pm$ 11.61
	Girl	317	41.85 $\pm$ 9.89
BMI (kg/m²)	Boy	240	18.94 $\pm$ 3.31
	Girl	317	18.50 $\pm$ 3.03
Age (year)	Boy	240	12.18 $\pm$ 1.29
	Girl	317	11.95 $\pm$ 1.23
Height (m)	Boy	240	1.51 $\pm$ 0.11
	Girl	317	1.49 $\pm$ 0.0

Variables are mean $\pm$ standard deviation (SD) or number. BMI: Body mass index Demographically similar groups

Demographically similar groups

It was determined that 5.7% ($n=32$) of the students who participated in the screening had a chronic disease and 3.6% ($n=20$) had been using medication continuously. Chronic diseases include diseases such as asthma, pneumonia, Familial Mediterranean Fever, rheumatic diseases, diabetes, disc hernia, and epilepsy. The drugs used by the students according to their statements are non-steroidal anti-inflammatory drugs, antidiabetic drugs, hormonal drugs, and antiepileptic drugs (Table 2 ,3).

Table 2. Percentage of Chronic Diseases in the research groups (Sivas, 2018)

Chronic Diseases	(%) Percent	N
Asthma	40.7	13
Pneumonia	18.7	6
Mediterranean Fever	6.2	2
Rheumatic Diseases	15.7	5
Diabetes	9.4	3
Disc Henrisis	6.2	2
Epilepsy	3.1	1
Total	100	32

Table 3. Percentage of Drugs Used in Chronic Diseases of the research groups (Sivas, 2018)

Drugs Used	(%) Percent	N
Non-Steroidal Anti-Inflammatory Drugs	25	5
Antidiabetic Drugs	15	3
Hormonal Drugs	55	11
Antiepileptic	5	1
Total	100	20

As a result of the scoliometer measurement, it was found that the right-sided curvature was the highest (41.8%) and double-sided curvature was the lowest (Table 4).

Table 4. The Prevalence of the Direction of Scoliotic Curvature in the research groups (Sivas, 2018)

The direction of Scoliotic Curvature	(%) Percent	N
No	37.2	207
Right	41.8	233
Left	20.5	114
Double	0.5	3
Total	100.0	557

Maximum curvature percentage on the right. When the diagnosis criteria of idiopathic scoliosis were taken as 10 degrees or more, the prevalence of scoliosis was found to be 0.7 % (n=4) (Table 4). As a result of the statistical analysis, the rate of scoliosis cases was found 4.7% in females and 5% in males. In 557 cases, 14 female students and 17 male students had scoliotic curvatures of 7 degrees or more. The degree of curvature in subjects was found to be at most 3 and 4 degrees (Table 5).

The spine level where scoliotic curvature was found most is the thoracic region with 49.6% and the least in the lumbar region with 0.9% (Table 6).

The rate of individuals who spent a lot of time at the desk was found as 41.3% (n=230). In the sample, the students carrying the school bag with one arm were found as 8.8% (n=49).

Table 5. Percentage of Rotational Curvature Degrees in the research groups (Sivas, 2018)

Percentage of Rotational Curvature Degrees	(%) Percent	N
0	37.2	207
2	9.3	52
3	18.0	100
4	10.8	60
5	14.9	83
6	4.3	24
7	2.9	16
8	1.6	9
9	0.4	2
10	0.7	4
Total	100.0	557

The degree of curvature in subjects was found to be at most 3 and 4 degrees.

Table 6. Prevalence of spine level where scoliotic curvature is found. in the research groups (Sivas, 2018)

Prevalence of spine level where scoliotic curvature is found	(%) Percent	N
None	37.2	206
Thoracic	49.6	276
Thoracolumbar	12.6	70
Lumbar	0.9	5
Total	100.0	557

**Figure1.** Scoliometer

The scoliosis curvature of the students was measured with a scoliometer.

DISCUSSIONS

Adolescent idiopathic scoliosis is a spinal curvature whose etiology is not known exactly and not associated with congenital and neurological abnormalities and onsets at the adolescent age continue until completion skeletal development with lateral curvature of the vertebrae (4, 12). It is a progressive problem that both disrupts the quality of daily life. Therefore, it is important to detect it at an early stage (5). In our study, the widespread effect of the easy-to-use and accessible scoliometer in the evaluation was targeted and appropriate results were achieved.

In our study, because of screening, when the diagnosis of idiopathic scoliosis was considered 10 degrees and above, the general prevalence of scoliosis was found to be 0.7 % in the 9-15 age group in the center of Sivas province. In a scoliosis prevalence study performed in Kırıkkale province in 2015, 2371 students between the ages of 10-13 were screened and on a basis, Cobb angle was to be 5 degrees and above, it was calculated as 2.23% for females and 0.56% for males (1). In a scoliosis prevalence study conducted at 6-14-year-olds in Singapore, a total of 72.699 people were screened and the general prevalence of idiopathic scoliosis with a Cobb angle of 10 degrees or more was 0.93% in females and 0.25% in males (13). In the prevalence study conducted in children aged 9-14 years in Greece, 82.901 children were screened and general scoliosis prevalence (for Cobb angle 10 degrees and above) was found to be 1.70% (2.6% in females and 0.9% in males) (14). In an AIS prevalence study conducted in Ankara in 1997, 4682 individuals aged 6-13 years were screened. A total of 1.07% (9.9% for females and 1.14% for males) individuals was found to have scoliosis with a Cobb angle of 5 degrees and above (15).

According to these three studies conducted, the general prevalence value of scoliosis in our current study was similar. Moreover, in our study, it was found that there were more scoliotic curvatures in male students, unlike other studies. Adolescent idiopathic scoliosis prevalence study performed in Ankara showed parallelism with the conclusion of our study (15).

In our country, there is not any scoliosis prevalence study to represent the whole population yet. Generally, such studies are regional studies. Therefore, the generalization of results is limited. In the prevalence study of AIS in primary schools in Bornova, Izmir, a total of 8372 students aged 12-14 were screened. Scoliosis prevalence with a Cobb angle of 5 degrees and above was found at 0.48% (7.7% for females and 0.20% for males) (16).

Among the most frequently used methods in scoliosis screening studies are Adam's Forward Bending Test, palpation, and radiographic methods (17). Adam's test's sensitivity has been reported between 73-100% and specificity has been reported between 68-99% (18). Adam's Forward Bending test has been used in many prevalence studies and it has been recognized as a successful evaluation method in literature (7). Adam's Forward Bending Test, which is used in scoliosis school screenings in Singapore has been described as an easy and time-saving test that allows for the detection of slight curvatures in the vertebral column, although it has shown false positives of 25% to 82% according to the assessment method and criteria used (19). In the study conducted in Greece, a forward bending test was applied similarly, and it was reported that this test was effective (17). Also, the sensitivity of Adam's Forward Bending test is directly related to the test applying a person's experience and knowledge. A study on this issue shows that this sensitivity ratio varies according to the researcher (19, 20). During the screening, while performing Adam's Forward Bending test, care must be taken that the feet of the observer are aligned to the feet of the subject, and that the hip is flexed 90 degrees and that the palms face at each other. Unless such technical conditions are considered, asymmetry of the vertebrae occurs, and the false positivity rate of Adam's forward bending test increases (21). For this reason, both environmental and technical requirements must be at the maximum level during screening. Our study was conducted taking this information into consideration.

Scoliometer is a specially designed inclinometer device that is easy to use and reliable in the

evaluation of scoliosis. It is included in the literature as a clinical evaluation method used with the radiological methods used to determine the effectiveness of the treatment and the prognosis of scoliosis (14,19,20,22). In our study, the rotational degree of scoliotic curvature was evaluated by a scoliometer. In a study conducted in 2004, the prevalence of scoliosis was examined by Adam's Forward Bending Test and palpation in students aged 10 to 15 in the center of Sivas Province, and it was suggested that the weakness of this study was the use of a scoliometer, which is an objective test instead of a subjective method such as Adam's Forward Bending Test (7). Because of this weakness, more objective data have been obtained in our study with a scoliometer. A recent study has stated that spinal rotation in the thoracic spine can be evaluated more appropriately with a scoliometer (23). Our study is separated from other studies as it uses the objective method of scoliometer.

In our study, while examining the prevalence of scoliosis, the angle of the direction of scoliotic curvature and the spine level of the scoliotic curvature was also evaluated. In our study, the direction of scoliotic curvature was found to be 41.8% in the right and 20.5% in the left. In a study conducted in Sivas in 2004, students with right-sided scoliotic curvature were found to be 80% and the left-sided was found to be 20% (7). In the other screenings on the prevalence of scoliosis, a grouping according to the direction of the scoliotic curvature was not performed. Moreover, bilateral scoliotic curvature has not been evaluated in any study. In our study, it was determined that 3 students (0.5%) had bilateral scoliotic curvature. In the screenings performed, different results have been encountered related to the level of the spine in which scoliosis is seen (7). Many studies conducted reported that curvature was observed at the thoracic-lumbar level in most of the individuals, followed by the curvature of the thoracic region in the second row (3,7, 24). In our study, the scoliotic curvature was found to be the most thoracic region with 49.6%. It was found in the thoracic-lumbar region with 12.6% and 0.9% in the lumbar region. These results are in line with

a study conducted in Izmir in 2012 (16).

With prolonged sitting at the desk at school of school-aged children, more inactive living and heavy bag carrying habits, deformities related to the spine such as adolescent scoliosis, kyphosis, scapula wings began to come to prominence. It is reported that the prevalence of scoliosis seen particularly in this age increases (25, 26,27). Carrying school bags with the same arm is effective in scoliosis occurrence. Based on answers filled according to students' statements for a questionnaire in a study where the correlation of frequency of computer use, bag carrying, and posture is evaluated for elementary school children, it was determined that 83.6% of them felt pain, particularly in their backs and this pain was related to an asymmetry in their spine although they have corrected bag carrying habits and do sports. The major reason for not finding a significant relationship between scoliotic curvature and spending prolonged time at desks and carrying a school bag with one arm in our study was the fact that answers to the questions were based on the statements of the students.

Both the training and the experience of the personnel performing tests on scoliosis prevalence are very important. Psychosocial issues will be prevented by providing the necessary guidance and appropriate exercises to the students with a scoliotic curvature of 7 degrees or higher (6, 14, 15, 28, 29).

CONCLUSIONS

Scoliosis, which is diagnosed at high rates as a result of the screenings with simple, easy-to-apply tests, causes socio-economic, psychological, and cosmetic problems if neglected (4,5, 21). For this purpose, families should be informed about the symptoms of scoliosis in our country. Additionally, early diagnosis will prevent the need for surgery and reduce the morbidity rate associated with scoliosis. Performing routine screening of scoliosis scans in our country and informing the families of students whose scoliotic curvature is 7 degrees or above will contribute to the resolution of this issue. In the study, the diagnosis was not

confirmed with radiographic imaging in children whose scoliosis was detected after screening. This situation, which can be considered a limitation of study, can be an example of eliminating this deficiency in future studies.

Consequently, we believe that the prevalence of the scoliotic curvature will be reduced by the teaching of correct posture and exercises by physiotherapists. Scoliosis screening, which is included in routine screening programs in other countries, should be legally implemented in our country.

Destekleyen Kuruluş: Yok

Çıkar Çatışması: Yok

Etik Onay: Çalışmanın yapılabilmesi için Sivas Cumhuriyet Üniversitesi

Girişimsel olmayan Klinik Araştırmalar Etik Kurulu'ndan etik kurul onayı alındı.

(Decision No: 2018-01/36)

Aydınlatılmış Onam: Çalışmaya başlamadan

önce çalışmanın amacı, süreci etkinliği hakkında

denekler bilgilendirildi ve gönüllülük esas alınarak

katılımcılardan yazılı onam alındı.

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