

## Low Back Awareness in Children with Adolescent Idiopathic Scoliosis and its Relationship Quality of Life

Adölesan İdiyopatik Skolyozlu Çocuklarda Bel Farkındalığı ile Yaşam Kalitesi Arasındaki İlişki

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### ABSTRACT

This study aimed to evaluate low back awareness and investigate the correlation between low back awareness and quality of life in children with adolescent idiopathic scoliosis (AIS). The study collected data from 40 children diagnosed with AIS and 40 healthy peers. Low back awareness was assessed using the Fremantle Back Awareness Questionnaire (FreBAQ), and quality of life was evaluated using the Scoliosis Research Society (SRS-22) form. Results showed that low back awareness was significantly lower in the AIS group compared to healthy children, and this awareness was associated with quality of life. Significant differences were found in the SRS-22 total score and especially in the "mental health" and "self-image" sub-dimensions compared to the healthy group ( $p<0.05$ ). A moderate negative correlation was identified between Cobb angle and quality of life ( $p<0.05$ ). The findings emphasize that decreased low back awareness in children with AIS may negatively affect the quality of life and the importance of personalized treatment approaches in these individuals.

**Keywords:** Awareness, Quality of Life, Scoliosis

### ÖZ

Bu çalışma, Adölesan İdiyopatik Skolyoz (AIS) olan çocuklarda bel farkındalığını değerlendirmeyi ve bel farkındalığı ile yaşam kalitesi arasındaki ilişkiyi incelemeyi amaçlamıştır. Çalışmada, AIS tanısı almış 40 çocuk ile sağlıklı 40 akranından veriler alınarak yürütülmüştür. Bel farkındalığı Fremantle Bel farkındalığı Anketi ile, yaşam kalitesi ise Scoliosis Research Society (SRS-22) formu ile değerlendirilmiştir. Bulgular, AIS grubunda bel farkındalığının sağlıklı çocuklara kıyasla anlamlı derecede düşük olduğunu ve bu farkındalığın yaşam kalitesi ile ilişkili olduğunu göstermiştir. SRS-22 toplam skorunda ve özellikle "mental sağlık" ve "öz-  
imaj" alt boyutlarında sağlıklı gruba göre anlamlı farklar saptanmıştır ( $p<0,05$ ). Cobb açısı ile yaşam kalitesi arasında da orta düzeyde negatif korelasyon bulunmuştur ( $p<0,05$ ). Bulgular, AIS olan çocuklarda bel farkındalığındaki azalmaların yaşam kalitesini olumsuz etkileyebileceğini ve bu bireylerde kişiselleştirilmiş tedavi yaklaşımlarının önemini vurgulamaktadır.

**Anahtar Kelimeler:** Farkındalık, Yaşam Kalitesi, Skolyoz

### Highlights

- \* Children with adolescent idiopathic scoliosis have poorer low back awareness compared to their peers.
- \* Low back awareness in children with adolescent idiopathic scoliosis is associated with quality of life.

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## INTRODUCTION

Adolescent Idiopathic Scoliosis (AIS) is a lateral spinal curvature of 10 degrees or greater, accompanied by vertebral rotation, observed in otherwise healthy adolescents<sup>1</sup>. AIS is the most common type of scoliosis, occurring in 1-4% of adolescents and affecting mostly female<sup>2</sup>. Diagnosis can be made by excluding other causes of scoliosis (e.g., vertebral malformation and neuromuscular disorder)<sup>3</sup>.

Low back pain has been identified as a potentially important risk factor in adolescents with AIS<sup>4,5</sup>. Adolescents with AIS may develop low back pain regardless of the size or location of the curve. Adolescents with AIS are more likely to experience chronic low back pain and more severe and prolonged acute pain than their peers<sup>1</sup>. The severity of pain is generally related to the patient's age, scoliosis area, and curve severity<sup>6</sup>. Adolescents with idiopathic scoliosis also have an altered awareness of their trunk and body alignment<sup>7</sup>. Studies indicate that after body awareness therapy, adolescents and young adults with idiopathic scoliosis exhibit diminished body awareness, a reduction in curve magnitude, and enhancements in body symmetry and trunk deformity<sup>8,9</sup>. Although there is significant evidence for clinicians regarding low back pain and body awareness in adolescents with AIS, there is no information regarding back-specific

awareness in this population. Therefore, this study aimed to examine low back awareness in adolescents with AIS. Back awareness refers to an individual's conscious understanding and perception of their back and its movements, position, and posture. It includes feeling and controlling the muscles and structures of the back to maintain posture, avoid unnecessary strain, and engage in activities with appropriate mechanics<sup>10</sup>.

In adolescents with AIS, quality of life is affected due to spinal dysfunction and degenerative changes accompanied by pain and stiffness. The general quality of life is assessed with the scoliosis-specific assessment questionnaire called the Scoliosis Research Society questionnaire (SRS-22)<sup>11</sup>. The life expectancy in adolescents with untreated AIS is similar to that of the general population, and it has been reported that these patients may develop health problems that may affect their short- and long-term health-related quality of life<sup>2,12</sup>. Recently, it has been reported that adolescents with AIS with chronic low back pain experience functional disability, sleep disturbances, and reduced quality of life<sup>13</sup>. This study sought to investigate the low back awareness of adolescents with AIS and to explain the correlation between low back awareness and quality of life.

## MATERIALS AND METHODS

### Ethical Aspects of the Research

This study was conducted using the principles of the Helsinki Declaration on patients diagnosed with AIS who applied to the Department of Physiotherapy and Rehabilitation at Erzurum Technical University. Voluntary consent forms were obtained from children who met the inclusion criteria and agreed to participate in the study and their families. Ethical approval was obtained from the Scientific Research and Publication Ethics Committee of Erzurum Technical University for the study (Number of

Meetings: 07, Number of Decisions: 9, Date: 06.06.2024).

### Participants

Power analysis was conducted using the G\*power software (version 3.1.9.2, Düsseldorf, Germany) to determine the number of participants required to participate in the study. According to the analysis, it was calculated that the study should be completed with at least 70 participants, 35 with AIS diagnosis and 35 healthy peers, with a 95% confidence interval, 0.05 significance level,

and 0.5 effect size. The study was completed with 80 participants, 40 in each group.

Adolescents aged 10-18 years with no orthopedic, neurological, or psychiatric problems other than scoliosis, who were diagnosed with AIS in the last month, did not use a corset, and whose significant curve was in the lumbar region were included in the study. Children with any mental disorders who had previously undergone scoliosis treatment and whose primary curve degree exceeded 40° were excluded from the study.

### Measurement

Demographic information of all individuals participating in the study was recorded. Scoliosis Research Society-22 (SRS-22) was utilized to evaluate the quality of life of the children, and the Fremantle Back Awareness Questionnaire (FreBAQ) was used to determine low back awareness. Both questionnaires were completed by children.

SRS-22: The Form comprises 22 questions and five subgroups. The subgroups consist of pain, image perception, spinal functions, mental health, and satisfaction with treatment. Since the participants were evaluated before treatment, this study did not use the satisfaction with treatment section. Each item scores 1 for the worst and 5 for the best. Elevated scores on the scale indicate an enhancement in quality of life, whereas diminished scores indicate a reduction. The maximum score is 110<sup>14</sup>. The Turkish version of the scale has validity and reliability.<sup>14</sup>

FreBAQ: It is a scale consisting of 9 questions that evaluate the awareness of the back area and has been studied for validity and reliability in Turkish. Each item consists of a 5-point Likert scale between 0 and 4; the overall score is obtained by adding these scores<sup>15</sup>.

### Statistical analysis

All statistical analyses were conducted utilizing SPSS (IBM SPSS Statistics for Windows, Version 25.0, Armonk, NY: IBM Corp.). The normal distribution of the data was evaluated using the Shapiro-Wilk test. Continuous variables are expressed as mean  $\pm$  standard deviation (SD). Categorical data are numerical values (n) and percentages (%). Comparisons between the two groups were conducted using either the t-test for independent samples or the Mann-Whitney U test, contingent upon the normality of the distribution. The chi-square or Fisher's exact test was used to compare categorical variables. The relationship between continuous variables was assessed using Pearson correlation analysis or Spearman rank correlation based on the distribution's normality. The Pearson correlation coefficient is classified as follows: very weak correlation: 0.00 – 0.19, weak correlation: 0.20 – 0.39, moderate correlation: 0.40 – 0.59, strong correlation: 0.60 – 0.79, very strong correlation: 0.80 – 1.00. The criterion for statistical significance is set at  $p < 0.05$ .

## RESULTS AND DISCUSSION

Demographic data of all adolescents who participated in the study are summarized in Table 1. The mean Cobb angle of children with AIS was  $26.25 \pm 11.24$  (Table 1).

Table 2 shows that FreBAQ scores were significantly higher in the AIS group than in healthy children ( $p < 0.05$ ). This indicates that individuals with AIS have less low back awareness. While there was no difference between the groups in the pain and function subscale, mental health, self-image, and SRS-

22 total scores were higher in favor of healthy adolescents ( $p < 0.05$ ).

A moderate negative correlation was found between the FreBAQ and SRS-22 total scores ( $r: -0.486, p < 0.001$ ). While no correlation was found between the FreBAQ score and the pain subscale ( $p > 0.05$ ), a weak negative correlation was found with the function and mental health subscale ( $r: -0.246, p = 0.028$ ;  $r: -0.341, p = 0.002$ , respectively), and a moderate negative correlation was found with the self-image subscale ( $r: -0.415, p < 0.001$ ).

A moderate negative correlation was observed between the Cobb angle and the SRS-22 total score, function, and self-image subscales ( $r=-0.542$ ,  $p<0.001$ ;  $r=-0.443$ ,

$p=0.004$ ,  $r=-0.506$ ,  $p<0.001$ , respectively). However, no correlation was identified between the Cobb angle and pain or mental health ( $p>0.05$ )(Table 3).

**Table 1. Characteristics of children participating in the study**

	Adolescents with AIS N=40	Healthy adolescents N=40	<i>p</i>
Age (years) (Mean $\pm$ SD)	14.55 $\pm$ 2.15	14.80 $\pm$ 1.88	0.582 <sup>a</sup>
Weight (kg) (Mean $\pm$ SD)	52.7 $\pm$ 5.59	56.08 $\pm$ 7.35	0.109 <sup>b</sup>
Height (cm) (Mean $\pm$ SD)	159.45 $\pm$ 7.17	158.38 $\pm$ 7.57	0.713 <sup>b</sup>
Gender (F/M) n (%)	31/9 (77.5/22.5)	33/7 (82.5/17.5)	0.576 <sup>c</sup>
Major curve magnitude (Cobb Angle)	26.25 $\pm$ 11.24	-	-
Risser, n (%)			
Immature (0-3)	24 (60)	-	-
Mature (4-5)	16 (40)		

a: Student's *t*-test, b: Mann-Whitney *U* test, c: Chi-square test, SD: Standard Deviation, kg: kilogram, cm: centimeter, F: Female, M: Male.

This study evaluated the relationship between low back awareness and quality of life in children with AIS. Both low back awareness and quality of life scores were found to be lower in children with AIS compared to their healthy peers. In addition, a relationship was found between low back awareness and quality of life in children with AIS.

Assessment of quality of life is critical to understanding the multifaceted effects of scoliosis on individuals' lives and to improve the treatment process. Kaya et al. indicated that scoliosis severity, perceived cosmetic deformity, degree of rotation, and depression levels were predictors of quality of life in children with AIS <sup>16</sup>. Mitsiaki et al. reported an association between AIS and mental health disorders such as depression, anxiety, and neuroticism <sup>17</sup>. Many studies show that the size of the Cobb angle is associated with quality of life <sup>18-20</sup>. In the current study, Cobb's angle was found to be related to quality of life, according to the literature. Considering this relationship and the fact that the quality of life scores of children with AIS are generally lower than their healthy peers, the assessment of quality of life should be considered an

important part of the treatment of AIS. These assessments may allow the development of holistic approaches appropriate for individuals' physical, psychological, and social needs rather than focusing only on correcting the curve.

Studies suggest that the link between pain and scoliosis is not strongly linked to a biomechanical problem <sup>21</sup>. Most studies have not shown a strong correlation of pain with Cobb angle <sup>22</sup>. In a prospective multicenter study, Lonner et al. showed no difference in pain scores of the SRS-22 questionnaire between the scoliosis group and controls <sup>23</sup>. In addition, it has been reported that there is no correlation or weak correlation between the size of the curves measured by Cobb angle and the presence of pain <sup>24-26</sup>. In this study, there was no difference between healthy children and children with aids in pain and function. This may be because we included children with a Cobb angle below 40 degrees. It should also be considered that pain and loss of function can be seen in advanced degrees <sup>27, 28</sup>.

Scoliosis is characterized by curvature of the spine and can significantly affect an individual's postural control, body perception,

and movement awareness<sup>29</sup>. Yağcı et al. found that body awareness was lower in children with AIS than those without AIS<sup>8</sup>. Picelli et al. also demonstrated the presence of an altered awareness of spinal alignment in patients suffering from AIS<sup>7</sup>. It has also been suggested that body schema changes parallel the development of spinal deformity in AIS<sup>30</sup>. Although body awareness and body schema have been examined in children with AIS in the literature, lumbar awareness has not been evaluated using a specific assessment tool for the lumbar region. Our study found that

children with scoliosis had lower low back awareness than their healthy peers. Abnormal somatosensory function, delayed central nervous system maturation, body schema disturbances, and vestibular dysfunction constitute neurodevelopmental etiological theories of idiopathic scoliosis<sup>31</sup>. We thought that scoliosis may affect the feedback mechanisms in the musculoskeletal system by disrupting the spine's alignment and that children with AIS may have impaired lumbar awareness for these reasons.

**Table 2. Comparison of participants' low back awareness and quality of life results**

	Adolescents with AIS N=40	Healthy adolescents N=40	p- value
<b>FreBAQ</b>	14.45 ± 4.02	10.62 ± 1.93	< <b>0.001</b>
<b>SRS-22 total</b>	3.75 ± 0.31	4.21 ± 0.2	< <b>0.001</b>
<b>Pain</b>	4.29 ± 0.46	4.45 ± 0.33	0.057
<b>Function</b>	4.35 ± 0.4	4.47 ± 0.4	0.148
<b>Mental health</b>	3.22 ± 0.7	3.77 ± 0.57	< <b>0.001</b>
<b>Self-Image</b>	3.16 ± 0.52	4.14 ± 0.43	< <b>0.001</b>

AIS: Adolescent Idiopathic Scoliosis, FreBAQ: Fremantle Back Awareness Questionnaire, SRS-22: Scoliosis Research Society-22.

Decreased body awareness in children with AIS may negatively affect quality of life<sup>32</sup>. It is also emphasized that decreased body awareness is associated with psychological effects, an important factor affecting quality of life<sup>32</sup>, especially deformity, which may promote a negative self-image in the individual who may experience difficulties in social interaction due to possible negative reactions from others due to the visibility of their condition<sup>33</sup>. Yağcı et al. demonstrated that diminished body awareness of the lower back correlates with pain, body image perception, reduced mental health, and impaired health-related quality of life<sup>8</sup>. In our study, low back awareness was also associated with parameters related to quality of life, such as Function, Mental health, and Self-Image. Low back awareness may be associated with more difficulty in daily activities. This may reduce the sense of

independence of children with scoliosis. This may increase their anxiety levels and cause depressive feelings. They may feel less competent than their healthy peers, so their emotional well-being may be negatively affected. Scoliosis can negatively affect body perception in individuals as it causes visible postural disturbances and a lack of awareness. Low back awareness may cause individuals not to understand or accept these posture differences. All these situations may explain the low back awareness in children with scoliosis and its relationship with quality of life. There are no studies specifically evaluating low back awareness in the literature. Assessing the low back awareness of people with scoliosis is critical in making treatment processes more effective and personalized.



**Table 3. The relationship between quality of life and low back awareness and Cobb angle in adolescents with AIS**

	FreBAQ		Cobb angle	
	r	p	r	p
<b>SRS-22 Total</b>	<b>-0.486</b>	<b>&lt;0.001</b>	<b>-0.542</b>	<b>&lt;0.001</b>
<b>Pain</b>	-0.092	0.417	-0.037	0.82
<b>Function</b>	<b>-0.246</b>	<b>0.028</b>	<b>-0.443</b>	<b>0.004</b>
<b>Mental health</b>	<b>-0.341</b>	<b>0.002</b>	-0.275	0.085
<b>Self-Image</b>	<b>-0.415</b>	<b>&lt;0.001</b>	<b>-0.506</b>	<b>&lt;0.001</b>

AIS: Adolescent Idiopathic Scoliosis, FreBAQ: Fremantle Back Awareness Questionnaire, SRS-22: Scoliosis Research Society-22.

## CONCLUSION AND RECOMMENDATION

This study highlights the significant relationship between reduced low back awareness and lower quality of life in adolescents with idiopathic scoliosis (AIS). Children with AIS demonstrated lower self-image and mental health scores, suggesting the psychological and functional impacts of decreased awareness. Additionally, the negative correlations between the FreBAQ, SRS-22 total score, and self-image underscore the importance of proprioceptive training in this population. The moderate correlation between Cobb angle and quality of life metrics further emphasizes the multifaceted impact of scoliosis on physical and psychosocial well-being. Comprehensive interventions addressing these factors are crucial.

### Research Limitations

A limitation of the study was that we determined the severity of scoliosis specified by Cobb as a wide range between 10-40 degrees in the study sample. Not dividing the severity of scoliosis into mild, moderate, and

severe groups may allow a more comprehensive examination of the effects of scoliosis.

### Conflict Of Interest

The authors declare that they have no conflict of interest regarding the publication of this article.

### Contributions By Authors

The contributions of the authors to the study are outlined below. All authors have reviewed and approved the final version of the manuscript for publication.

**R.Y.;** contributed to the composition of the study through review, editing, and supervision.

**M.E.;** contributed to the data collection and analysis for the study.

**A.Y.;** contributed to the research, conceptualization, methodology development, and analysis of the study.

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