

The Impact of Spinal Deformities on Quality of Life: A Cross-Sectional Survey in Patients with Scoliosis in Saudi Arabia

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ABSTRACT

Scoliosis is a chronic musculoskeletal condition characterized by three-dimensional spinal deformity that has functional and psychosocial consequences. It is associated with physical limitations, and impaired body image, all of which contribute to diminished health-related quality of life (QoL). Investigating these outcomes is essential to inform patient-centered management strategies. This study aimed to evaluate QoL among patients with scoliosis in Saudi Arabia and to examine the relationship between deformity severity and patient-reported outcomes. We conducted a cross-sectional study among patients aged ≥ 10 years with radiographically confirmed idiopathic scoliosis (Cobb angle $\geq 10^\circ$) attending tertiary hospitals and spine clinics in Saudi Arabia. Exclusion criteria included secondary scoliosis, unrelated spinal surgery, or chronic debilitating illness. Stratified sampling was applied. Data were collected using the validated Arabic version of the Scoliosis Research Society-22 (SRS-22) questionnaire, covering five domains: function, pain, self-image, mental health, and satisfaction. Descriptive statistics, correlation analysis, and linear regression were performed using SPSS v26. A p-value < 0.05 was considered significant. The pain subscale yielded a mean of 2.4 ± 0.9 , while self-image (3.1 ± 0.7), function (3.0 ± 0.5), and mental health (3.0 ± 0.4) showed higher values. Satisfaction recorded the highest scores (3.5 ± 1.3). The overall mean QoL score was 2.9 ± 0.2 . Regression analysis demonstrated that higher pain severity significantly reduced QoL ($\beta = -0.15$, $p < 0.001$), while greater function/mobility improved QoL ($\beta = 0.11$, $p = 0.014$). Strong correlations were observed between self-image and satisfaction ($r = 0.77$), and inverse correlations between satisfaction and pain ($r = -0.66$). Pain correlated positively with mental health ($r = 0.52$). Patients with scoliosis experience reduced QoL, with pain and self-image having the strongest influence on outcomes. Satisfaction was closely linked to both pain and body image, emphasizing the psychosocial burden of scoliosis. Early, multidisciplinary interventions targeting both physical and psychosocial domains are essential to improve overall QoL in scoliosis patients.

Keywords: *Scoliosis; Quality of life; SRS-22; Pain; Self-image; Psychosocial impact; Saudi Arabia*

INTRODUCTION

Scoliosis is a complex three-dimensional deformity of the spine, defined as a lateral curvature greater than 10 degrees measured by the Cobb angle on radiographs¹. In adults, the pooled prevalence of de novo scoliosis has been estimated at 37.6% (95% CI: 18.7–61.8)². Among children and adolescents, adolescent idiopathic scoliosis is the most common spinal deformity, affecting 0.5%–5.2% of those aged 10–16 years worldwide³. In Saudi Arabia, a national school-based screening program reported a prevalence of 0.48%⁴.

Patients with scoliosis often present with diverse symptoms, including back pain, neurological deficits⁵, impaired pulmonary function, and psychological difficulties^{6,7}. The impact extends beyond the physical curvature; scoliosis can substantially diminish overall quality of life. Pain, limited physical function, and emotional distress are consistently reported, particularly in individuals with more severe deformities⁷⁻¹⁰.

Early detection and proper management are crucial to limit progression, as untreated cases may advance to severe curvatures associated with functional decline and reduced life quality¹¹. The psychosocial consequences are especially pronounced in adolescents: the visible deformity may lead to body-image concerns, reduced self-esteem, and social withdrawal⁷. This highlights the need for psychosocial evaluation as part of holistic care.

In adults, the burden also remains high. Chronic pain, physical limitations, and long-term functional impairments are common, reinforcing the wide-ranging effects of scoliosis on health-related quality of life¹².

Given these findings, this study aims to evaluate quality of life in patients with scoliosis and to explore the relationship between deformity severity and patient-reported outcomes.

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METHODOLOGY

Study Design, population and settings: This is a cross-sectional study conducted among individuals diagnosed with idiopathic scoliosis who are being managed at tertiary care hospitals or spine clinics, including both pediatric and adult populations. The eligible patients should have a confirmed diagnosis of idiopathic scoliosis based on radiographic imaging (Cobb angle $\geq 10^\circ$), be aged ≥ 10 years, and be either undergoing treatment or have completed treatment within the last 12 months, and be able to provide informed consent and adequately understand the survey to complete patient-reported outcome measures.

However, we excluded patients with secondary scoliosis due to neuromuscular disorders, congenital malformations, or syndromic conditions, those with a history of spinal surgery unrelated to scoliosis correction and patients with active malignancies or chronic debilitating illnesses that could confound quality of life measures.

Sample size calculation: The sample size was calculated using the Raosoft sample size calculator¹³. Considering a margin of error of 5%, an expected proportion of 10%¹⁴, a 95% confidence interval, and a total population of 72000 according to the 2022 Census¹⁵, the minimum required sample size was 139.

Sampling Technique: We used Stratified sampling to ensure representation of different scoliosis severities and treatment modalities.

Data Collection Methods: We utilized patient-reported outcomes with data collected through an online questionnaire at the outpatient orthopedic and spine surgery clinics in Saudi Arabia. The questionnaire was disseminated either through patient groups on WhatsApp or via patient acquaintances known to data collectors and researchers.

The questionnaire includes Quality of life assessed using the validated Arabic version of the Scoliosis Research Society (SRS-22)

questionnaire. It is made up of 22 items and consists of five domains: function/activity, pain, self-image/appearance, mental health, and satisfaction with management, each item's score ranges from 1 to 5 with higher scores indicating a higher quality of life. The total score ranged between 22 and 110¹⁶.

Data Analysis: Data were analyzed using SPSS version 26. Categorical data were summarized using counts and percentages, while numerical data were reported as medians and interquartile ranges. We tested for normal distribution using the Kolmogorov-Smirnov test. The linear regression model was used to evaluate the association between pain severity and overall quality-of-life (removing the pain subscale from the overall score). It is also used to assess the association between mobility and overall quality-of-life (removing the function/mobility subscale from the overall score). A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations: The study was approved by the Research Ethics Committee at King Abdullah International Medical Research Center in Saudi Arabia. Informed consent was obtained from all participants or their guardians. Participation was voluntary, with the option to withdraw without consequences. Participants' personal information was kept confidential.

RESULTS

The study included 139 participants. The pain subscale had a mean score of 2.4 ± 0.9 with a median (IQR) of 2.5 (1.2). The self-image subscale showed a higher mean of 3.1 ± 0.7 and a median of 3.2 (1). Function/mobility recorded a mean of 3 ± 0.5 and a median of 3 (0.8), while the mental health domain had a mean of 3 ± 0.4 and a median of 3 (0.6). The satisfaction subscale yielded the highest scores, with a mean of 3.5 ± 1.3 and a median of 3.5 (1.5). The overall total score was 2.9 ± 0.2 with a median of 2.91 (0.23) Figure 1.

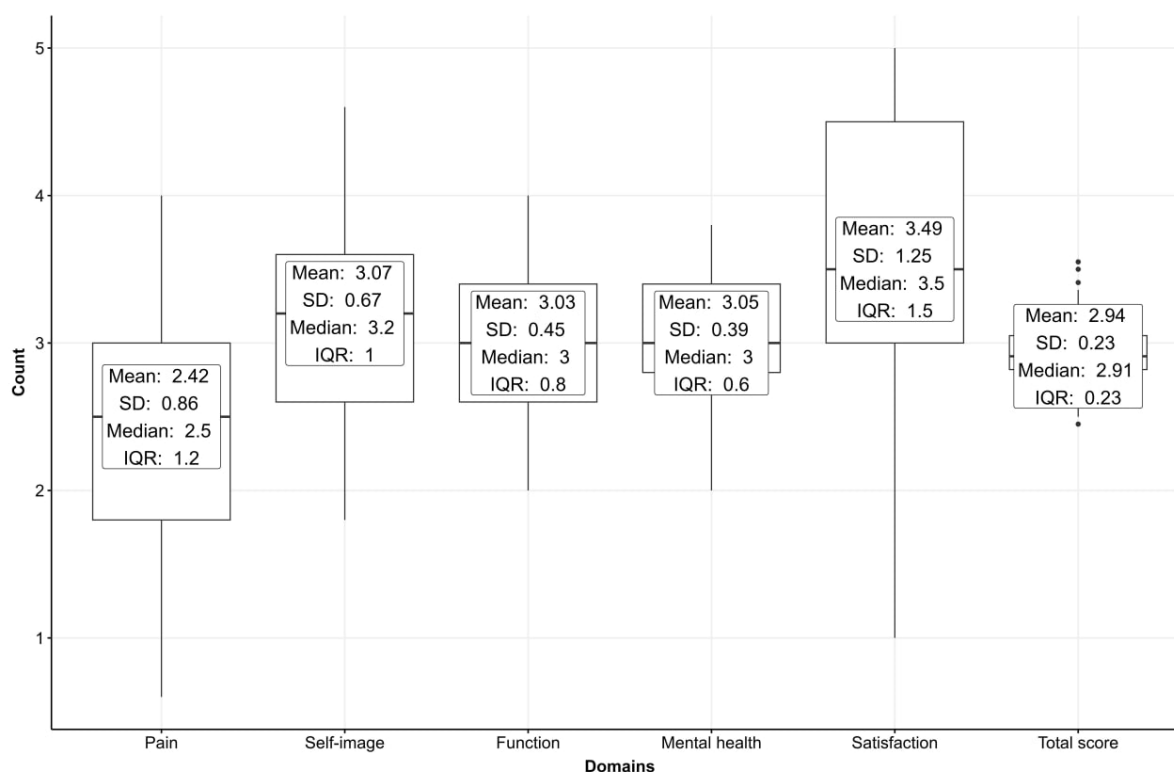


Figure 1. SRS-22r domains—score distributions and summary statistics

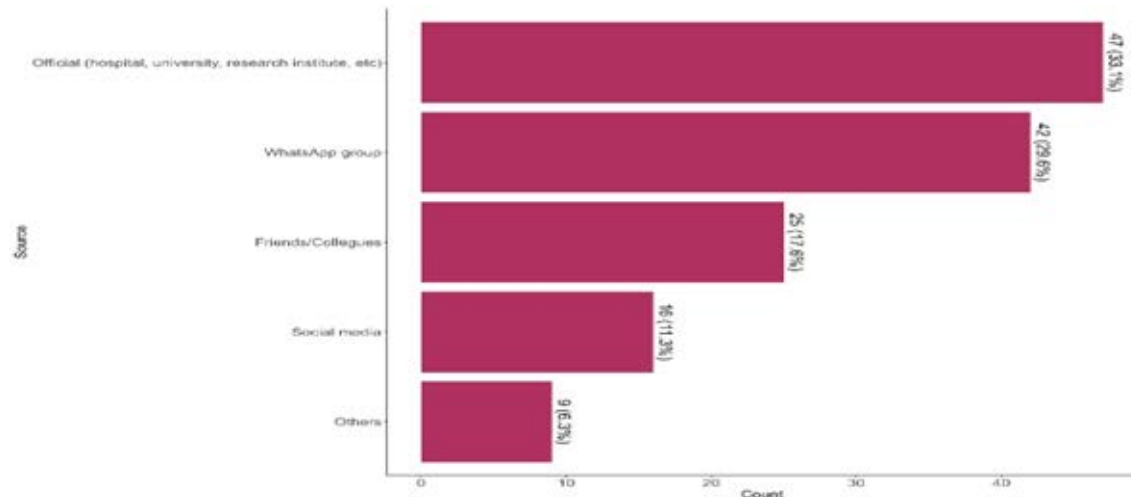


Figure 2. Reported information sources among participants

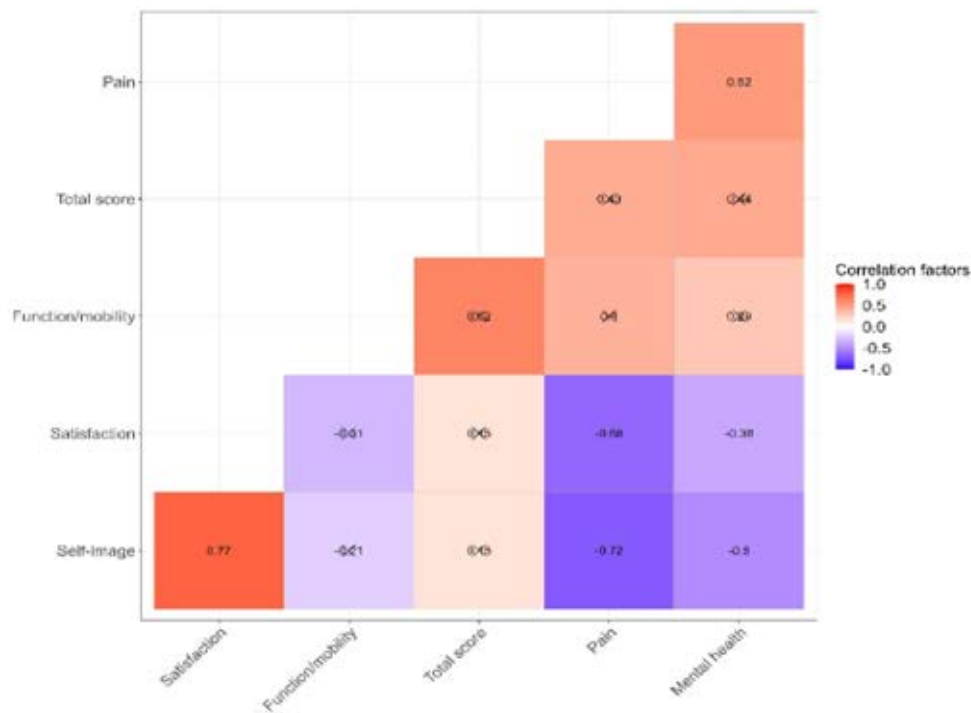


Figure 3. Inter-domain correlations of SRS-22r scores

Table 1. Association Between Quality of Life Scores and SRS-22r Domains

Characteristic	Quality of life score		
	Beta	95% CI ¹	p-value
Pain domain	-0.15	-0.20, -0.09	<0.001
Function/mobility domain	0.11	0.02, 0.19	0.014

¹CI = Confidence Interval

Regarding questionnaire distribution, the most common source was official platforms such as hospitals, universities, or research institutes (33.1%), followed by WhatsApp groups (29.6%) and friends/colleagues (17.6%) Figure 2.

Regression analysis demonstrated that greater pain severity was significantly associated with lower overall quality-of-life scores when the pain domain was excluded ($\beta = -0.15$, $p < 0.001$). In contrast, higher function/mobility scores were positively associated with better

overall quality-of-life scores when the function domain was excluded ($\beta = 0.11$, $p = 0.014$) Table 1.

The correlation revealed that self-image was strongly and positively correlated with satisfaction ($r = 0.77$, $p < 0.05$), while having significant negative correlations with pain ($r = -0.72$, $p < 0.05$) and mental health ($r = -0.50$, $p < 0.05$). Similarly, satisfaction was inversely correlated with pain ($r = -0.66$, $p < 0.05$). In contrast, correlations of satisfaction with function/mobility ($r = -0.41$), satisfaction with total score ($r = 0.15$), function/mobility with mental health, and total score with pain were not statistically significant.

Function/mobility showed a significant positive correlation with total score ($r = 0.52$, $p < 0.05$), whereas pain correlated positively with mental health ($r = 0.52$, $p < 0.05$). Therefore, self-image and satisfaction are the most influential domains, demonstrating significant correlations with both pain and mental health, while other correlations were weak or not statistically significant Figure 3.

DISCUSSION

This study aimed to evaluate the quality of life among patients diagnosed with idiopathic scoliosis in Saudi Arabia. Overall, the findings revealed a moderate quality of life, with the satisfaction domain scoring the highest, while the pain domain scored the lowest.

Compared with studies conducted in Sweden, Iran, and China^{9,17,18}, the quality of life in our study was relatively lower, which may be attributed to differences in healthcare systems, cultural contexts, and study populations. A previous Saudi study reported an average Scoliosis Research Society-22 score of 3 out of 5, which is almost consistent with our results⁴, underscoring the influence of cultural factors and community support within the same population. However, this low quality of life, both in our study and in previous Saudi research, requires serious attention, especially given the absence of a national registry and the limited awareness of the disease in Saudi Arabia^{19,20}.

Among the subscales, treatment satisfaction recorded the highest mean score, which was higher than that reported in the Brazilian study²¹. This may be explained by the direct improvement in curve size observed on frontal radiographs after surgery, as well as improvements in cosmetic appearance. The second most affected subscale was self-image. It is well established that patients with idiopathic scoliosis often experience dissatisfaction with their physical appearance and self-perceived body image, which may lead to feelings of “embarrassment” and “inferiority”²². Self-image is strongly influenced by disease severity, as more severe scoliosis has been shown to correlate negatively with body image²³. In our study, the relatively less impaired self-image domain may reflect the lower severity of scoliosis among participants.

The third and fourth affected domains were mental health and function/mobility, respectively, both of which scored lower compared to findings from a previous Iranian study¹⁷). Mental health distress in idiopathic scoliosis patients has been defined as the psychological burden caused by spinal deformity or brace use. Evidence suggests that distress associated with bracing is significantly greater than that caused by spinal deformity itself²⁴. Furthermore, higher cognitive function, greater independence, and negative parental attitudes have been linked to an increased incidence of depression in these patients²⁴. Cultural factors in Saudi Arabia may also contribute to the lower scores in the mental health domain. Regarding function/mobility, loss of spinal mobility can occur following extensive vertebral fusion, and scoliosis patients who undergo spinal fusion have been shown to exhibit less mobility compared to untreated patients²⁵.

The most severely affected domain was pain. Multiple studies have reported that back pain is the most common presenting symptom in scoliotic patients^{26,27}, with a lifetime prevalence of 58.8%¹⁹. Given its significant impact, this highly affected domain warrants urgent attention from healthcare authorities.

In this study, greater pain severity was significantly associated with lower overall quality-of-life scores, consistent with findings from Swedish and Turkish studies^{9,28}. Conversely, higher function/mobility scores were positively associated with better quality of life, which is understandable since preserved mobility allows patients to perform daily activities more independently, engage in social interactions, and sustain psychological well-being. Satisfaction with treatment was inversely correlated with pain, which aligns with the clinical goal of scoliosis treatment—preventing curve progression and long-term complications such as back pain²⁹.

Self-image was also found to be strongly and positively correlated with satisfaction with treatment. Notably, a previous study demonstrated

that patients who received emotional support from healthcare providers reported significantly higher self-image scores compared to those who did not, highlighting the role of clinician support as part of treatment³⁰. Furthermore, self-image showed a significant negative correlation with pain, in agreement with earlier research²⁸.

This study provides important insights into the quality of life of Saudi patients with scoliosis, strengthened by the inclusion of participants from multiple centers. Nevertheless, its findings should be interpreted with caution due to the inherent limitations of a cross-sectional design. In addition, the absence of detailed demographic data may restrict a deeper understanding of the characteristics of the study population.

CONCLUSION

This study found that patients with idiopathic scoliosis in Saudi Arabia generally experience a moderate quality of life, with the highest scores observed in treatment satisfaction and the lowest in the pain domain. Efforts should focus on early detection and effective management of scoliosis to reduce pain and preserve mobility. Emotional and clinical support should be strengthened to improve self-image and satisfaction with treatment. Awareness campaigns and patient education programs are needed to enhance understanding of the disease. Establishing a national scoliosis registry and improving access to specialized care across multiple centers can help guide treatment and improve overall quality of life.

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