Disordered Eating and Body Image Concerns in Young Adult Women With Scoliosis

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ABSTRACT

BACKGROUND: Researchers have called for more investigation into disordered eating behaviors in females with scoliosis.

OBJECTIVE: The objective of the current study was to assess the associations between body image concerns, disease-specific indicators of scoliosis (ie, age of diagnosis, having undergone bracing treatment, being told by a physician your scoliosis required surgery, having a spinal fusion), quality of life, and disordered eating in a sample of young adult women diagnosed with idiopathic scoliosis during adolescence.

DESIGN: This study was cross-sectional in design.

METHODS: Participants were 177 young adult women ages 18 to 30 years diagnosed with idiopathic scoliosis by a physician who completed questionnaires online.

RESULTS: Undergoing bracing treatment ($r = -.440$; $P < .001$), greater age at scoliosis diagnosis ($r = .563$; $P < .001$), being told scoliosis required surgery ($r = -.196$; $P < .050$), annual income ($r = .306$; $P < .001$), level of education ($r = .228$; $P < .010$), and race/ethnicity ($r = -.213$; $P < .050$) were associated with the EDE-Q Global Score. The Body Shape Questionnaire Total Score and EDE-Q Global Score ($r = .848$; $P < .001$) and EDE-Q Weight Concern Score ($r = .813$; $P < .001$) were associated. The strongest correlations between the EDE-Q and the SRS-22-Revised Subscales were generally evidenced on the SRS-22-Revised Mental Health Subscale (rs ranged from $-.200$ to $-.371$; $P < .001$). After controlling for annual income, highest level of education, undergoing bracing treatment, and age of scoliosis diagnosis, the Body Shape Questionnaire Total Score was significantly correlated with the EDE-Q Eating Concern Score (standardized beta coefficient = .618; $P < .001$).

CONCLUSIONS: These findings underscore the importance of assessing body image concerns in young adult women with scoliosis experiencing disordered eating as this information may provide valuable information relevant to treatment planning.

KEYWORDS: Scoliosis, disordered eating, body image, women, young adult

Scoliosis is a musculoskeletal disorder characterized by sideways curvature in the spine. Approximately 6 to 9 million people are diagnosed with scoliosis in the United States.[1] Idiopathic scoliosis, which indicates the etiology of the spinal curvature is not known and likely caused by multiple factors, is the most prevalent type of scoliosis.[2,3] Females are diagnosed with idiopathic scoliosis at higher rates[4,5] and tend to present with greater severity of spinal curvature.[6]

Existing research assessing disordered eating behaviors in females with scoliosis has yielded mixed findings, prompting researchers to call for further investigation into this topic. A recent study by Cantele et al[7] found that female adolescents with idiopathic scoliosis demonstrated less eating psychopathology in comparison with a control sample; there were no differences in eating disorder pathology between adolescent females with idiopathic scoliosis who were braced versus not braced. Other studies have found that females with scoliosis are more likely to be underweight[8,9] and low body mass index is associated with poorer outcomes after spinal surgery.[10] Similarly, studies have reported greater odds of scoliosis in adolescent females with anorexia nervosa[11] and greater severity of deviation of the vertebral column in adolescent females with scoliosis and anorexia nervosa.[12]

While there is some evidence that women with scoliosis may be at an increased risk of experiencing disordered eating symptoms, potential risk factors for disordered eating in this population have not been thoroughly investigated, including body image concerns, which are well-documented in patients with scoliosis.[13-15] A recent literature review on the effects of adolescent idiopathic scoliosis on psychological comorbidities found that body image concerns were the most important link between psychological difficulties and adolescent idiopathic scoliosis.[16] It is critical to understand the associations between body image concerns and disordered eating in this population as such information could help inform prevention and intervention programs aimed at reducing disordered eating behaviors in young adult females with scoliosis. Other limitations of the existing studies is that they almost exclusively focused on adolescent females with scoliosis,[7,11,12,17] despite young adulthood being a peak period for the development and manifestation of disordered eating.[18]

The objective of the current study was to assess the associations between body image concerns, disease-specific indicators of scoliosis (ie, age of diagnosis, having undergone bracing treatment, being told by a physician your scoliosis required surgery, having a spinal fusion), quality of life, and disordered eating in young adult women with idiopathic scoliosis. We hypothesized that greater body image concerns would be associated with more disordered eating and poorer quality of life in our sample of young adult women with idiopathic scoliosis.

Materials and Methods

Participants and procedures

Participants in this cross-sectional study were 177 young adult women aged 18 to 30 years from the United States who reported being diagnosed with idiopathic scoliosis by a physician during adolescence. Participants were a convenience sample recruited from Amazon's Mechanical Turk between September 2018 and July 2020. The description of the study on Mechanical Turk indicated this was a study about eating habits. Potential participants who were interested in the study completed a brief screening survey which asked about their gender, age range, and country of residence. Potential participants were also asked to endorse whether they had one or more of the following chronic health conditions: type I diabetes, type II diabetes, psoriasis, scoliosis (idiopathic), heart disease, kidney failure, breast cancer, other cancer, Parkinson disease, amputated limb, heart murmur, fibromyalgia, chronic pain, sickle cell anemia, cystic fibrosis, cerebral palsy, other chronic health condition. Potential participants could also indicate they did not have any chronic health conditions. Potential participants who indicated having idiopathic scoliosis and being a female between the ages of 18 and 30 years residing in the United States were presented with 2 additional screening questions about whether they were diagnosed with scoliosis by a physician and at what age. Women who reported they were diagnosed with scoliosis by a physician between the ages of 10 and 18 years were presented with the online consent form. Potential participants were asked to read through the online consent form and if they agreed to the procedures outlined in the consent form, to click on a box at the bottom of the form that indicated their consent to participate in the study. Potential participants had the option of declining participation in the study after reading the consent form by clicking on the decline box at the bottom of the form. Once consent was provided, potential participants were able to proceed to the full study questionnaires on Qualtrics including the EDE-Q, SRS-22-Revised, Body Shape Questionnaire, and a questionnaire about disease-specific indicators of scoliosis and demographic characteristics.

Participants who completed the questionnaires were provided monetary compensation through Mechanical Turk. Following the recommendations provided by Chandler and Shapiro,[19] repeated participation was prevented and prescreening was conducted in an unobtrusive manner. No identifying information was collected on participants. All study procedures were approved by the Baylor University Institutional Review Board (IRB Net Identification number 1176779-2).

Measures

EDE-Q. The Eating Disorder Examination Questionnaire (EDE-Q) is a 28-item self-report measure that assesses eating behaviors relevant to eating disorders.[20] The EDE-Q has a Global Score and 4 subscales including Dietary Restraint, Eating Concern, Shape Concern, and Weight Concern. Participants rated items on a 7-point Likert scale. Four questions about height, weight, menstrual periods, and whether using the "pill" are asked at the end of the questionnaire. Higher scores indicate greater eating disorder concerns. The EDE-Q Global Score has evidenced strong internal consistency reliability (Cronbach α = .94). The 4 subscales also have demonstrated good internal consistency reliability (Cronbach α = .75, .78, .81, and .90).[21] Good criterion-related validity and convergent validity have also been reported for this measure.[22,23]

SRS-22-Revised. Scoliosis Research Society-22-Revised Questionnaire is a 22-item measure that was developed to evaluate quality of life in patients with scoliosis.[24] The measure is made up of a Total Score and 5 subscales including Function, Pain, Mental Health, Self-Image, and Satisfaction with Management. Each item is scored on a Likert scale ranging from 1 to 5 where higher scores indicate better quality of life outcomes.[24] While good internal consistency was reported for the SRS-22 Total Score (Cronbach α = .827),[25] internal consistency reliability among the 5 subscales has been more variable (Function, Cronbach α = .78; Pain, Cronbach α = .79; Mental Health, Cronbach α = .92; Self-Image, Cronbach α = .88; and Satisfaction with Management, Cronbach α = .66).[24] Test-retest reliability was acceptable for all subscales (Function, ICC = 0.78; Pain, ICC = 0.81; Self-Image, ICC = 0.88; Mental Health, ICC = 0.82; Satisfaction with Management, ICC = 0.79).[24] Acceptable concurrent validity and discriminant validity has been found in individuals with scoliosis.[26,27]

Body Shape Questionnaire. The Body Shape Questionnaire Short-Version is an 8-item questionnaire that assesses body image concerns.[28] This measure is scored on a 6-point Likert scale ranging from "never" to "always." Higher scores reflect more severe body image concerns or dissatisfaction. The Body Shape Questionnaire Short-Version has evidenced strong internal consistency (Cronbach α = .93) and test-retest reliability (r = 0.95) in an undergraduate sample.[29] This measure has also demonstrated acceptable convergent validity.[30]

Disease-specific indicators of scoliosis and demographic information. Participants completed a question about the age their scoliosis diagnosis was made by a physician. They were also asked

if they had undergone bracing treatment, were ever told by a physician their scoliosis required surgery, and if they had ever undergone a spinal fusion. Participants reported on their age, highest level of education, race/ethnicity, and annual income.

Statistical analysis. The percentage of missing data was computed for the main study variables. Pearson correlations were examined between demographic characteristics (ie, age, race/ethnicity, annual household income, highest level of education), disease-specific indicators of scoliosis (ie, age of diagnosis, having undergone bracing treatment, being told by a physician your scoliosis required surgery, having a spinal fusion), the Body Shape Questionnaire, SRS-22-Revised, and the EDE-Q. Pearson correlations were classified as small (.10-.29), medium (.30-.49), and large (>.50).

Hierarchical multiple linear regression analysis was used to assess the multivariate associations between body shape concerns and disordered eating. The EDE-Q Eating Concerns Score was the criterion variable in the regression model. Sociodemographic variables (annual income, highest level of education) and disease-specific indicators of scoliosis (undergoing bracing treatment, age of scoliosis diagnosis) that were significantly correlated with the EDE-Q Eating Concerns Score in the Pearson correlation analyses were entered into block 1 as control variables. In block 2, the Body Shape Questionnaire Total Score was entered to determine whether body image concerns incremented the variance explained in the final adjusted model for which disordered eating was the outcome.

Results

Missing data

For the scoliosis sample, 6.8% of all item responses were missing on the EDE-Q, 4.8% of all item responses were missing on the SRS-22-Revised, and 4.2% of all item responses were missing on the Body Shape Questionnaire.

Participant characteristics

Table 1 contains the demographic characteristics of the scoliosis sample. The mean age of young adult women in the sample was 26.09 years (SD = 4.58; range = 18-30 years). Most participants identified as white (74.0%) and had obtained a minimum of a college degree (76.2%). Mean age of scoliosis diagnosis for the sample was 15.54 years (SD = 3.95). A little over half of participants (52.5%) indicated they had undergone bracing treatment for their scoliosis. Approximately one-third of participants (27.7%) indicated they were told by their physician their scoliosis required surgery. Most participants (93.2%) reported they had never had a spinal fusion.

Pearson correlations

Table 2 contains the Pearson correlations between the EDE-Q, demographic variables, and disease-specific indicators of

Table 1. Demographic variables for the samples.

CHARACTERISTIC	SCOLIOSIS		
	N OR MEAN	% OR SD	RANGE
Age	26.09	4.58	19-60
Annual income			
Less than $25 000	23	13.0	—
$25 000 to $49 999	38	21.4	—
$50 000 to 74 999	41	23.2	
$75 000 to $99 999	64	36.3	—
$100 000 or more	8	4.6	—
Missing	2	1.1	—
Race/ethnicity			
White/Caucasian	131	74.0	—
Hispanic	25	14.1	—
African American	6	3.4	—
Native American/ American Indian	2	1.1	—
Asian/Pacific Islander	5	2.8	—
Other	1	0.6	
Missing	7	4.0	—
Highest level of education			
High school diploma/ GED	10	5.6	—
Vocational school or some college	30	17.0	—
College degree	83	46.9	—
Professional or graduate degree	52	29.3	—
Missing	2	1.1	—

scoliosis. Undergoing bracing treatment, greater age at scoliosis diagnosis, being told scoliosis required surgery, annual income, level of education, and race/ethnicity were associated with the EDE-Q Global Score. Race/ethnicity, undergoing bracing treatment, and age of scoliosis diagnosis were associated with the EDE-Q Weight Concern Score. Annual income, highest level of education, race/ethnicity, undergoing bracing treatment, being told scoliosis required surgery, and age of scoliosis diagnosis were associated with the EDE-Q Eating Concern Score. All of the correlations were in the small to medium range. The correlation between age of scoliosis diagnosis and EDE-Q Eating Concerns Score approached the large range.

Table 3 presents the Pearson correlations between the EDE-Q, Body Shape Questionnaire, and SRS-22-Revised. The correlations between the Body Shape Questionnaire and EDE-Q Global Score and Subscale Scores were all significant

Table 2. Pearson correlations for Eating Disorder Examination Questionnaire (EDE-Q), demographic information, and disease-specific indicators of scoliosis.

SCALE	AGE	ANNUAL INCOME	HIGHEST LEVEL OF EDUCATION	RACE/ ETHNICITY	DID YOU EVER UNDERGO BRACING TREATMENT FOR YOUR SCOLIOSIS?	AT WHAT AGE WERE YOU DIAGNOSED WITH SCOLIOSIS	WERE YOU EVER TOLD BY A DOCTOR THAT YOUR SCOLIOSIS REQUIRED SURGERY?	DID YOU HAVE A SPINAL FUSION?
EDE-Q: global score	.053	.306***	.228**	−.213*	−.440***	.563***	−0.196*	.065
EDE-Q: restraint subscale	.009	.319***	.300***	−.160	−.330***	.513***	−.158	.103
EDE-Q: eating concern subscale	.068	.229**	.322**	−.237**	−.397***	.525***	−.162*	.096
EDE-Q: Shape Concern Subscale	.076	.196*	.235**	−.215*	−.295***	.412***	−.200*	.035
EDE-Q: weight concern subscale	.040	.092	.067	−.170*	−.234**	.293***	−.086	.079

For annual income, "less than $25 000" was coded as 1, "$25 000 to $34 999" as 2, "$35 000 to $49 999" as 3, "$50 000 to $74 999" as 4, "$75 000 to $99 999" as 5, "$100 000 to $149 999" as 6, and "$150 000 or more" as 7. For highest level of education, "No high school" was coded as 1, "Some high school, no diploma" as 2, "High school graduate, diploma or the equivalent" as 3, "Some college credit, no degree" as 4, "Trade/technical/vocational training" as 5, "Associate's degree" as 6, "Bachelor's degree" as 7, "Master's degree" as 8, and "Professional/Doctoral Degree" as 9. Hispanic, African American, Native American/American Indian, Asian/Pacific Islander, and Other were collapsed into the category "non-white" and coded as 2. White participants were coded as 1. For the disease-specific variables (undergoing bracing treatment, being told by a doctor that scoliosis required surgery, and having spinal fusion) were coded as 1 for "Yes" and 2 for "No."
*$P < .050$; **$P < .010$; ***$P < .001$.

Table 3. Correlations for Eating Disorder Examination Questionnaire (EDE-Q), Scoliosis Research Society-22-Revised Questionnaire (SRS-22-Revised), and Body Shape Questionnaire.

SCALE	BODY SHAPE QUESTIONNAIRE	SRS-22-REVISED TOTAL SCORE	SRS-22: FUNCTION	SRS-22: PAIN	SRS-22: MENTAL HEALTH	SRS-22: SELF-IMAGE	SRS-22: MANAGEMENT SATISFACTION
EDE-Q: global score	.848***	.075	−.066	.350***	−.369***	.131	−.094
EDE-Q: restraint subscale	.647***	.101	.006	.330***	−.254**	.117	−.051
EDE-Q: eating concern subscale	.766***	.030	−.043	.266***	−.371***	.098	−.103
EDE-Q: Shape Concern Subscale	.802***	.114	−.080	.211*	−.269**	.172*	−.039
EDE-Q: weight concern subscale	.813***	.170*	.028	.150	−.200*	.195*	.023

*$P < .050$; **$P < .010$; ***$P < .001$.

and in the large range. The largest correlations were evidenced between the Body Shape Questionnaire Total Score and EDE-Q Global Score and EDE-Q Weight Concern Score. The SRS-22-Revised Total Score was associated with the EDE-Q Weight Concern Score. The strongest correlations between the EDE-Q and the SRS-22-Revised Subscales were generally evidenced on the SRS-22-Revised Mental Health Subscale.

Hierarchical multiple linear regression analysis

Table 4 presents standardized beta coefficients for the hierarchical multiple linear regression analysis from the total model, which included all predictors. The variance explained by the total adjusted model, for which eating concerns was the outcome, was significant. In the final model after controlling for annual income, highest level of education, undergoing bracing treatment, and age of scoliosis diagnosis, the Body Shape Questionnaire Total Score were significantly correlated with the EDE-Q Eating Concerns Score.

Discussion

The present study assessed the associations between body image concerns, disease-specific indicators of scoliosis, quality of life, and disordered eating in young adult women with idiopathic scoliosis who were diagnosed with scoliosis during adolescence. Demographic characteristics associated with more severe disordered eating in our sample included higher annual income and

Table 4. Hierarchical regression analysis predicting eating concerns.

PREDICTORS	EDE-Q EATING CONCERNS
Block 1	
R^2	.356***
Annual income	−.022
Highest level of education	.075
Undergoing bracing treatment	−.150**
Age of scoliosis diagnosis	.182**
Block 2	
$R^2\Delta$	.293***
Body Shape Questionnaire	.618***
Cumulative R^2	.650***

Abbreviation: EDE-Q, Eating Disorder Examination Questionnaire.
Betas presented are standardized betas for the full model.
**Significant at $P < .010$ level.
***Significant at $P < .001$ level.

higher level of educational attainment. Being an older age in adolescence when diagnosed with scoliosis and undergoing bracing treatment, which is often indicative of more severe spinal curvature,[31] were also associated with greater disordered eating in our sample of young adult women with scoliosis. In a recent scoping review, Bertuccelli et al[32] found that more pronounced body dissatisfaction was reported in adolescents with greater severity of idiopathic scoliosis. Taken as a whole, these findings point to potential risk factors for the development of disordered eating in young adult women with scoliosis, including greater severity of idiopathic scoliosis. While having a higher educational attainment/income and undergoing bracing treatments have been previously identified as risk factors for the development of disordered eating in women,[13,33-35] to the best of our knowledge, the present study is the first to identify older age during adolescence when diagnosed with scoliosis as a factor relevant to disordered eating in this population. Consequently, young adult women who have been diagnosed with scoliosis later in adolescence and have undergone bracing treatments may be especially important to routinely screen for symptoms of disordered eating. Future longitudinal studies are needed to examine the temporal associations between the potential risk factors identified in this study and the emergence of disordered eating in young adult women with scoliosis.

Body shape concerns were associated with disordered eating in our sample of young adult women with scoliosis, in that greater body shape concerns were associated with higher levels of disordered eating. This significant association remained after controlling for relevant demographic and disease-specific variables. This finding is consistent with a recent literature review that identified body image concerns as one of the most important factors in the development of psychological comorbidities among adolescents with idiopathic scoliosis.[16] Taken as a whole, these findings underscore the importance of assessing body image concerns in

young adult women with scoliosis experiencing disordered eating as this information may provide valuable information relevant to treatment planning. While the EDE-Q contains a Shape Concern Subscale, it is worth noting that this subscale strongly correlated with the Body Shape Questionnaire Short-Form in the current study. As such a brief measure like the 8-item Body Shape Questionnaire Short-Form may provide unique information about body shape concerns in this population above and beyond what is captured in the EDE-Q. While existing studies have demonstrated adequate psychometric properties of the Body Shape Questionnaire Short-Form in community populations,[30] it will be important for future studies to evaluate the incremental validity of the Body Shape Questionnaire Short-Form in young adult women with scoliosis.

Greater eating concerns were associated with diminished quality of life in our sample of young adult women with scoliosis, particularly in the domains of mental health and pain. These findings are consistent with previous research conducted more broadly with adults[36] and adolescents with disordered eating[37] and point to the importance of evaluating mental health in young adult women with scoliosis. Considering elevated problems with self-image and body shape, clinicians who work with young adult women with scoliosis should routinely assess for mental health difficulties in this population, which may facilitate the early identification of young adult women with scoliosis who can benefit from psychological interventions.[38] Cognitive-behavioral interventions may help young adult women with scoliosis develop coping mechanisms for addressing physical pain and psychosocial problems. While in the current study the temporal association between mental health problems and disordered eating was not able to be determined, it is likely that diminished mental health not only serves as risk factor for emerging disordered eating, but also continues to be adversely impacted as an individual develops more severe disordered eating.

There were a number of limitations to this study. The cross-sectional design precludes us from inferring causation among the study variables. While all participants underwent a rigorous screening process to ensure they met inclusion criteria for the study, recruitment on Mechanical Turk may limit the generalizability of our findings. Furthermore, participants reported retrospectively on disease-specific variables such as age of scoliosis diagnosis and whether they underwent bracing treatments, which may have been impacted by recall bias. Finally, the current study was advertised as one about eating behaviors; it is possible that individuals with disordered eating and concerns about their body image were less likely to participate in the study due to the advertised description.

In conclusion, greater body shape concerns were associated with more severe disordered eating in our sample of young adult women with scoliosis. This association remained after controlling for relevant demographic and disease-specific variables. Higher annual income, higher level of educational attainment, undergoing bracing treatments, and being an older age in adolescence when diagnosed

with scoliosis were associated with greater disordered eating in our sample. Eating concerns were associated with lower quality of life in our sample, particularly in the area of mental health.

Declarations

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Author Contributions
Christine A Limbers: Conceptualization; Formal analysis; Investigation; Methodology; Project administration; Supervision; Writing—original draft; Writing—review & editing.
Amy Baskin: Formal analysis; Methodology; Writing—original draft; Writing—review & editing.
L Adelyn Cohen: Data curation; Formal analysis; Investigation; Methodology; Writing—original draft; Writing—review & editing.

Ethics Approval and Consent to Participate
All study procedures were approved by the Baylor University Institutional Review Board (IRB Net Identification number 1176779-2). Consent was obtained from all participants prior to their participation in the study.

Consent for Publication
The manuscript has been reviewed and approved by all authors and they have given necessary attention to ensure the integrity of the work, and have agreed to it being submitted for publication. Consent was also obtained from participants for publication of the study.

Availability of Data and Materials
Data and materials are available upon reasonable request from the first author.

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