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Article

Examining kinesiophobia as a predictor of somatization, anxiety, and phobia in patients with sickle cell disease

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Abstract: Sickle cell disease (SCD) is a chronic hematologic condition characterized by recurrent pain crises that contribute to psychological distress and activity avoidance. The fear of movement due to anticipated pain (Kinesiophobia) has been identified as an important factor within chronic pain literature, yet it is an underexplored factor within chronic pain conditions like SCD, particularly in relation to psychological symptom expression. The present study examined whether age and kinesiophobia are associated with symptom dimensions of somatization, anxiety, and specific phobia in adults with SCD. Participants (N = 100–102) were recruited from a medical center in North Carolina, where they completed the Tampa Scale of Kinesiophobia (TSK) and the Symptom Checklist-90-R (SCL-90-R). Hierarchical linear regression analyses were utilized to assess the predictive value of age and kinesiophobia across symptom domains. In any model, age did not emerge as a significant predictor. The inclusion of kinesiophobia significantly improved the somatization model, accounting for an additional 7.3% of variance, and emerged as a statistically significant predictor, $\beta = 0.255$, $p = 0.011$. Conversely, neither age nor kinesiophobia emerged as significant predictors of anxiety or specific phobia in this sample. The findings suggest that kinesiophobia may be more specifically associated with somatic symptom expression rather than broader domains of psychological distress in individuals with SCD. Further research is needed to examine the mechanisms that underlie this relationship and to determine if targeting kinesiophobia in this population may improve clinical outcomes.

Keywords: chronic pain; kinesiophobia; somatization; hemoglobinopathies; anxiety; specific phobias

1. Introduction

The global burden of anxiety disorders has escalated dramatically, with lifetime prevalence rates reaching 34% in the general population and 51.1% among individuals with chronic illness. Between 1990 and 2019, diagnosed anxiety disorders increased

from 31.1 million to 45.8 million cases worldwide, with total cases surpassing 300 million (Balaram and Marwaha, 2024; Javaid et al., 2023; Swathi et al., 2023; Yang et al., 2021). This upward trajectory, further accelerated by the COVID-19 pandemic, disproportionately affects vulnerable populations, particularly those navigating chronic disease management (Wu et al., 2025).

Anxiety manifests through psychological and physiological pathways, with generalized anxiety disorder representing one of the most prevalent subtypes. Characterized by persistent, excessive worry that interferes with daily functioning, anxiety often presents with somatic manifestations including restlessness, fatigue, muscle tension, and sleep disturbance (DeMartini et al., 2019; Rowa et al., 2017). These physiological symptoms create a bidirectional relationship between psychological distress and physical sensation, a phenomenon particularly salient in chronic pain populations.

Kinesiophobia, defined as the persistent, irrational fear of movement stemming from perceived vulnerability to pain or reinjury (Kori, 1990), represents a specific phobic response with profound implications for chronic disease management. Prevalence estimates indicate that 56–78% of chronic pain patients globally experience kinesiophobia (Bränström and Fahlström, 2008; Li et al., 2023; Perrot et al., 2018), yet this construct remains inadequately characterized within specific disease populations. The intersection of kinesiophobia with somatization and anxiety in chronic pain patients warrants systematic investigation, particularly in conditions where pain episodes are unpredictable and severe.

Sickle cell disease (SCD) exemplifies a chronic illness fundamentally characterized by recurrent, unpredictable pain crises resulting from vaso-occlusive episodes (Edwards et al., 2006). The pathophysiology of SCD creates a unique context for examining kinesiophobia: patients experience legitimate, tissue-damaging pain episodes that can be triggered or exacerbated by physical exertion, environmental stressors, or dehydration (Edwards et al., 2006; Harrison et al., 2005; Pells et al., 2007). This distinguishes SCD from many chronic pain conditions where the relationship between movement and tissue damage is less direct. Consequently, individuals with SCD may develop adaptive vigilance that, when excessive, manifests as kinesiophobia, a fear response that paradoxically may intensify symptom perception and contribute to functional decline through activity avoidance and physical deconditioning.

Despite the clinical significance of kinesiophobia in chronic pain management, its predictive relationship with psychological symptom dimensions remains poorly understood in SCD populations. Specifically, whether kinesiophobia functions primarily as a pain-specific fear construct or extends to broader anxiety and somatization patterns has not been adequately elucidated. Understanding these relationships carries critical implications for intervention development, as treatment approaches may differ substantially depending on whether kinesiophobia represents a circumscribed movement-related fear or reflects more generalized psychological distress with somatic expression.

The present investigation addresses this gap by examining kinesiophobia as a predictor of three distinct psychological symptom dimensions in adults with

SCD: somatization, generalized anxiety, and specific phobia. We hypothesized that kinesiophobia would significantly predict somatization—the experience and reporting of physical symptoms in response to psychological distress—given the inherent overlap between fear-related physiological arousal and somatic symptom perception. Conversely, we hypothesized that kinesiophobia would not significantly predict generalized anxiety or broader phobic responses, as these constructs represent more diffuse psychological phenomena extending beyond movement-specific concerns. This differential prediction model allows us to test whether kinesiophobia in SCD functions as a specific, pain-related fear construct or constitutes a manifestation of broader psychopathology.

2. Materials and methods

2.1. Study design

The current study is an archival component of a larger longitudinal parent study. The parent study, conducted from 2001 to 2017, sought to evaluate the impact of medical, genetic, and psychosocial factors on the outcomes of SCD patients. More specifically, this study evaluated the relationships and predictive power of kinesiophobia on three factors: somatization, anxiety, and phobia.

2.2. Participants

The parent study recruited 256 African American patients from the division of hematology at a medical center in North Carolina. At the time of data collection, the medical center provided routine care for 360 SCD patients each year.

The study hematologist recruited participants during routine medical evaluations. Exclusionary criteria included whether they were actively experiencing an acute pain episode or an urgent medical crisis, had been previously diagnosed with an eating disorder, or if they were unable to read or comprehend the written instructions provided. Typical reasons cited by patients who declined to participate included: (1) time constraints, (2) already being involved in another research study, or (3) disinterest in participating in scientific research.

This study included 102 Black participants with SCD ($\bar{x}$ age = 35.89 years old). Only subjects who completed the Tampa Scale of Kinesiophobia and the Symptom Checklist-90 were included in this analysis. The Duke Institutional Review Board approved the study. All subjects were given and signed informed consent.

2.3. Measures

2.3.1. Longitudinal exploration of medical and psychosocial factors in sickle cell disease (LEMPFSCD)

The LEMPFSCD is an empirically validated multidimensional survey instrument designed to assess sickle cell disease in patients. The instrument consists of 700 questions relating to pain, demographic data, and 8 other validated instruments assessing social, behavioral, and psychiatric functioning. These instruments include the Symptoms Checklist 90-Items-Revised, the Tampa Scale of Kinesiophobia, the Beck

Depression Inventory, the Multidimensional Pain Inventory, the Short Form McGill Pain Questionnaire, the Menstrual Symptoms Questionnaire, the Marlowe Crowne Scale of Social Desirability, the Duke Religiosity Scale, and the John Henryism Scale (Edwards et al., 2006; Harrison et al., 2005; Pells et al., 2007). For the current study, we examined responses on the Tampa Scale of Kinesiophobia and the Symptom Checklist-90-Items-Revised.

2.3.2. Tampa Scale of Kinesiophobia (TSK)

The TSK was originally developed to assess the severity of pain-related fear in patients with chronic health conditions. The measure consists of seventeen Likert-style items assessing the patients' fear of movement and/or (re)injury due to movement. Example items include statements such as, "I am afraid that I might injure myself accidentally," and "Pain always means I have injured my body." Patients score individual items on a 4-point scale: a score of 1 = "Strongly disagree," 2 = "somewhat disagree," 3 = "Somewhat agree," and 4 = "Strongly agree." Items 4, 8, 12, and 16 are reversed-scored, but all other items are scored individually. A licensed clinician will interpret the results of the instrument by finding the sum of scores (ranging from 17 to 68). The higher the sum, the greater the degree of kinesiophobia a patient experiences, with scores above 37 being considered significant and requiring intervention. The TSK is a reliable and valid psychometric instrument with a Cronbach's alpha ranging from 0.68 to.80 (Crombez et al., 1999; Vlaeyen et al., 1995a, 1995b). Although the TSK was not originally developed for use in SCD, prior research suggests that pain-related fears are relevant in this population (Pells et al., 2007). Evidence regarding the factor structure and measurement invariance in the TSK specifically within the context of SCD remains limited, and further validation work is needed.

2.3.3. Symptom Checklist-90-Revised (SCL-90-R)

The SCL-90-R is a 90-item Likert-style questionnaire used to assess the degree and presence of common psychological symptomatic dimensions within a patient. These psychopathologies include somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, anger-hostility, phobic-anxiety, paranoid, and psychosis. General sensitivity index (GSI), positive symptom distress index (PSDI), and positive symptom total (PST) are scored under "additional items" (items 19, 44, 59, 60, 64, 66, and 89). Patients score individual items on a 5-point scale: a score of 0 = an answer of "Not at all," 1 = "A little bit," 2 = "Moderately," 3 = "Quite a bit," and 4 = "Extremely." A licensed clinician will interpret the results of the instrument by finding the sum of scores per individual dimension, then offering a total score using the sum of all dimensions. Internal consistency for the subscales ranges from 0.77 to 0.90 (Derogatis et al., 1976).

2.4. Procedure

Study procedures are described in previously published papers that explored kinesiophobia, pain and religiosity in SCD (Reid, 2026; Pells et al., 2007).

Patients were referred to the study by the study hematologist based on eligibility according to the inclusionary and exclusionary criteria. Study personnel approached

patients about participation and provided a brief overview of the study. Patients were informed that the study would include a review of their healthcare utilization based on patterns in their medical records. All patients were provided with informed consent forms and encouraged to ask questions for clarification before signing. All patients were enrolled individually in the current study. After enrollment, patients were provided with a copy of the survey and, when possible, relocated to a relatively isolated or quiet area of the waiting area. A member of the study team provided instructions for the completion of the survey, and additional clarification and instructions were provided as requested. When patients completed the survey, they were collected and provided an informal debriefing.

2.5. Statistical analysis

The current study utilized the latest version of IBM Statistical Package for the Social Sciences (i.e., SPSS; IBM Corp, 2023) to conduct statistical analyses. Listwise deletion was utilized to separate complete responses to the associated domains on the SCL-90-R and to determine the sample sizes for each dependent variable. While the missing data mechanism was not formally tested, the limited extent of missingness suggests that its impact on the results is likely minimal. Listwise deletion was selected to maintain consistency across analyses. Descriptive statistics were used to summarize the sample characteristics. Hierarchical linear regressions were performed to examine age and Tampa Scale for Kinesiophobia (TSK) scores in predicting anxiety, phobia, and somatization. In block 1, age was added as a predictor for each dependent variable. In block 2, TSK scores were added while controlling for age to determine the predictive value of TSK scores for each dependent variable. Correlation matrices and coefficient tables are included. Significance was determined at $p < 0.05$, and changes in R^2 were examined to assess model improvement.

A sensitivity power analysis was conducted to estimate the smallest effect size that was detectable with the present sample size (N = 100–102) at an alpha level of 0.05. With the two-predictor models, the current sample provided adequate power to detect medium effect sizes ($f^2 \approx 0.13$–0.15) but it was not large enough to reliably detect small effect sizes ($f^2 < 0.08$).

3. Results

Hierarchical linear regression analyses were performed to assess whether age and kinesiophobia scores were predictive of three symptom dimensions from the SCL-90: Somatization, anxiety, and phobia. All variables were entered using listwise deletion for missing data, which yielded sample sizes of 100–102 cases per model. Descriptive statistics for all study variables are presented in **Table 1**.

Table 1. Descriptive Statistics.

Variable	Mean	SD	N
Anxiety	53.48	12.9	102
Age	35.89	11.52	102
Kinesiophobia	32.17	6.713	102

Table 1. *Cont.*

Variable	Mean	SD	N
Specific Phobia	52.14	10.52	102
Age	35.89	11.52	102
Kinesiophobia	32.17	6.713	102
Somatization	59.99	10.38	100
Age	35.82	11.59	100
Kinesiophobia	32.21	6.74	100

3.1. Anxiety

The correlation matrix for anxiety is depicted in **Table 2**. Pearson correlations indicated a small and nonsignificant relationship between anxiety and age, and a statistically significant positive correlation between anxiety and kinesiophobia. Hierarchical linear regressions were conducted to further examine the relationship and determine the predictive power of age and kinesiophobia on anxiety as measured by the SCL-90-R.

Table 2. Correlations of Anxiety.

Variables	Anxiety	Age
Pearson Correlation		
Age	−0.116	
Kinesiophobia	0.19	−0.004
Sig. (1-tailed)		
Age	0.124	
Kinesiophobia	0.028*	0.486

Note: Dependent Variable: Anxiety. Pearson Correlation—Linear correlation across data. Sig.: Significance, *p*-value, *$p < 0.05$.

The first of the hierarchical regression models tested age and kinesiophobia as predictors of anxiety in this sample. The first model included only age as a predictor and was nonsignificant. The second model included age and kinesiophobia as predictors of anxiety. The addition of kinesiophobia did not significantly improve model fit. The overall model did not reach statistical significance. Within the model, kinesiophobia was not a statistically significant predictor of anxiety.

3.2. Specific phobia

The correlation matrix for specific phobia is depicted in **Table 3**. Pearson correlations indicated small and nonsignificant relationships between specific phobia, age, and kinesiophobia. Hierarchical linear regressions were conducted to further examine these nonsignificant relationships and determine the possible predictive power of age and kinesiophobia on specific phobias as measured by the SCL-90-R.

Table 3. Correlations of Specific Phobia.

Variables	Specific phobia	Age
Pearson Correlation		
Age	−0.155	
Kinesiophobia	0.108	−0.004

Table 3. *Cont.*

Variables	Specific phobia	Age
Sig. (1-tailed)		
Age	0.06	
Kinesiophobia	0.14	0.486

Note: Dependent Variable: Specific phobia. Pearson Correlation—Linear correlation across data. Sig.: Significance.

The second hierarchical regression tested age and kinesiophobia as predictors of specific phobia in this sample. The first model included only age as a predictor, and was not statistically significant. The second model, with the addition of kinesiophobia as a predictor, did not improve model fit. Within the model, neither kinesiophobia nor age were statistically significant predictors.

3.3. Somatization

The correlation matrix for somatization is depicted in **Table 4**. Pearson correlations indicated a statistically significant positive relationship between somatization and kinesiophobia, and a small and nonsignificant relationship between somatization and age. Hierarchical linear regression was conducted to examine the relationships and determine the predictive power of kinesiophobia on somatization as measured by the SCL-90-R.

Table 4. Correlations of Somatization.

Variables	Somatization	Age
Pearson Correlation		
Age	−0.087	
Kinesiophobia	0.256	−0.007
Sig. (1-tailed)		
Age	0.194	
Kinesiophobia	0.005*	0.471

Note: Dependent Variable: Somatization. Pearson Correlation—Linear correlation across data. Sig.: Significance, *p*-value, *$p < 0.05$.

The final hierarchical linear regression included age and kinesiophobia as predictors of somatization in this sample. The first model only included age as a predictor and was nonsignificant. The second model added kinesiophobia as a predictor, which significantly improved the model fit. Within the model, kinesiophobia was associated with higher somatization, while age remained nonsignificant. Hierarchical regression model summaries are depicted in **Table 5**, and regression coefficients are depicted in **Table 6**.

Table 5. Hierarchical Linear Regression of Model Summaries.

Model	R	R^2	ΔR^2	F	*p*
Anxiety					
Model 1	0.116	0.013	0.003	1.354	0.247
Model 2	0.222	0.049	0.03	2.565	0.082
Specific Phobia					
Model 1	0.155	0.024	0.024	2.459	0.12
Model 2	0.188	0.035	0.011	1.822	0.167

Table 5. *Cont.*

Model	R	R^2	ΔR^2	F	*p*
Somatization					
Model 1	0.087	0.008	0.008	0.751	0.388
Model 2	0.27	0.073	0.065	3.799	0.026*

Note: Predictors in Model 1: (Constant), Age. Predictors in Model 2: (Constant), Age, Kinesiophobia. Asterisks (*) denote significant predictors, *$p < 0.05$.

Table 6. Regression Coefficients.

Predictor	β (SE)	Standardized β coefficient	*t*	*p*
Anxiety				
Model 1				
Constant	58.13		13.87	
Age	−0.129	−0.0116	−1.164	0.247
Model 2				
Constant	46.39		6.319	
Age	−0.129	−0.115	−1.173	0.244
Kinesiophobia	0.364	0.189	1.934	0.056
Specific Phobia				
Model 1				
Constant	57.21		16.84	
Age	−0.141	−0.155	−1.568	0.12
Model 2				
Constant	51.79		8.588	
Age	−0.141	−0.155	−1.566	0.121
Kinesiophobia	0.168	0.107	1.086	0.28
Somatization				
Model 1				
Constant	62.79		18.53	
Age	−0.078	−0.087	−0.867	0.388
Model 2				
Constant	50.09		8.526	
Age	−0.076	−0.085	−0.873	0.385
Kinesiophobia	0.392	0.255	2.608	0.011*

Note: Values represent standardized and unstandardized (β) coefficients from hierarchical linear regression. Asterisks (*) denote significant predictors, *$p < 0.05$.

4. Discussion

This investigation represents a systematic examination of kinesiophobia as a statistical predictor of distinct psychological symptom dimensions in adults with sickle cell disease. Our findings indicate a modest, statistically significant relationship between kinesiophobia and somatization that may be clinically meaningful in the context of chronic pain and sickle cell disease. Kinesiophobia emerged as a significant independent predictor of somatization, accounting for 7.3% of variance beyond age alone. This relationship remained robust when controlling for age, suggesting that movement-related fear is meaningfully related to the physical expression of psychological distress in this population. Kinesiophobia was not significantly associated with phobic anxiety and was not a statistically significant predictor of generalized anxiety. These findings suggest that kinesiophobia may be more specifically related to somatic symptom expression rather than representing a

generalized fear construct in SCD; However, this interpretation should be considered carefully, given the limited power to detect small effects. The cross-sectional design of the study precludes causal inference; all findings should be interpreted as associative, given that no conclusions regarding temporal direction or causality can be drawn with this study design.

The selective prediction of somatization by kinesiophobia represents a critical finding with multiple interpretations. First, this pattern suggests that kinesiophobia may be reflective of psychophysiological mechanisms distinct from those underlying generalized anxiety or specific phobias. The fear-avoidance model, extensively validated in musculoskeletal pain conditions, posits that pain-related fear initiates a cascade of cognitive, emotional, and behavioral responses that perpetuate disability beyond what physical pathology alone would predict (Lucchetti et al., 2012; Van Middendorp et al., 2010; Zhuo, 2016). Our findings are consistent with this model, demonstrating that movement-related fear is associated with somatic symptom perception through heightened interoceptive attention and autonomic arousal in patients with SCD.

The kinesiophobia-somatization relationship in SCD may reflect a unique interplay between legitimate disease-related concerns and maladaptive cognitive-emotional processing. Unlike many chronic pain conditions, where kinesiophobia represents purely maladaptive catastrophizing, individuals with SCD have experienced genuine, severe pain episodes triggered by physical exertion, dehydration, or environmental stressors. This experiential history may contribute to a complex scenario wherein some movement-related vigilance may represent appropriate disease management, while excessive fear becomes maladaptive (Zale and Ditre, 2015). Our findings suggest that individuals may report more experiences of benign bodily sensations as threatening, manifesting as increased somatization.

Several mechanistic pathways may help explain the observed kinesiophobia-somatization relationship. Kinesiophobia may be associated with sympathetic nervous system arousal patterns that mirror those associated with actual pain episodes. When individuals with SCD anticipate movement-related pain, this anticipatory anxiety may be associated with physiological responses including increased heart rate, muscle tension, cortisol elevation, and altered respiratory patterns (Yoshihara et al., 2016). These physiological changes may correspond with interoceptive signals that individuals may interpret as prodromal disease symptoms. In this context, the heightened physiological arousal and movement-related vigilance may be associated with greater reporting of movement avoidance and increased somatic preoccupation (Wolters et al., 2022). The present data do not allow for the determination of the temporal activation of these physiological and perceptual processes with kinesiophobia and somatization.

Kinesiophobia may be associated with differences in interoceptive sensitivity of internal bodily states. Research demonstrates that somatization disorders and related conditions are characterized by hypervigilance to bodily sensations, with individuals showing heightened interoceptive accuracy coupled with catastrophic interpretation of normal physiological variations. For SCD patients, who must vigilantly monitor

symptoms to identify genuine pain crises, this interoceptive hypervigilance serves an adaptive function. However, when coupled with kinesiophobia, this vigilance may be elevated, which may be associated with increased reporting of somatic symptoms in response to the physiological arousal generated by movement-related fear itself.

The relationship observed between kinesiophobia and somatization may also be understood within a cognitive and behavioral framework. The fear-avoidance model (Crombez et al., 1999; Vlaeyen et al., 1995a, 1995b) describes a sequence of interrelated cognitive processes that include pain catastrophizing, fear of movement, avoidance behaviors, physical deconditioning, and heightened attention to bodily sensations (Lucchetti et al., 2012). The fear-avoidance model has been proposed to co-occur with the maintenance of pain-related disability (Lucchetti et al., 2012). The present study did not assess all components of this model; however, the selective association between kinesiophobia and somatization is consistent with the possibility that movement-related fear is linked to movement-related vigilance, interoceptive attention, and the reporting of somatic symptoms.

Pain catastrophizing, or the tendency toward magnification, rumination, and helplessness regarding pain experiences (Allen et al., 2012; Quartana et al., 2009; Keefe et al, 1989; Sil et al., 2016; Van Denburg et al., 2018). may be particularly salient in this context. Pain catastrophizing demonstrates elevated prevalence in SCD populations compared to other chronic pain conditions, potentially reflecting the unique biological, psychological, and social burdens of this disease. Extant literature suggests that kinesiophobia and pain catastrophizing are closely related constructs, and co-occurrence may be associated with greater symptom reporting in populations with chronic pain (Wood et al., 2023; Aily et al., 2021). Pain catastrophizing was not evaluated in the present study, limiting the ability to assess its potential role as a mediating or confounding variable. Further study incorporating validated measures, such as the Pain Catastrophizing Scale (Sullivan et al., 1995), will be instrumental in the clarification of the relationships among these constructs. Additionally, distinction between adaptive and maladaptive kinesiophobia in this population is an important conceptual consideration. While some degree of movement-related caution may be reflective of appropriate disease management, elevated levels of kinesiophobia may be associated with increased functional limitation and symptom reporting. The present study did not include measures that allow for empirical differentiation between the forms of kinesiophobia, illuminating another important pathway for future evaluation.

The interpretation of our findings must acknowledge the broader sociocultural context of SCD management. As a condition predominantly affecting Black individuals, SCD exists within a healthcare system characterized by persistent racial disparities, including inadequate pain management, delayed care provision, and implicit bias affecting clinical decision-making (Kramer et al., 2021). These systemic factors were not assessed in the present study; however, they may represent important contextual influences on patient pain experience, symptom reporting, and kinesiophobia. When individuals repeatedly experience dismissal of their pain reports or inadequate analgesia may be associated with heightened fear of pain and diminished confidence in healthcare systems' capacity to provide relief. This dynamic

may be associated with both movement-related fear and somatic symptom reporting, representing an understandable adaptation to systemic failures rather than individual pathology. Future research should directly examine the role of healthcare experience, perceived discrimination, medical mistrust, and access to effective pain management in the shaping of kinesiophobia and somatization in this population. The incorporation of these variables may provide clarification of the broader contextual factors associated with symptom expression and movement-related fear.

Our findings carry several critical clinical implications. The identification of kinesiophobia as a significant predictor of somatization suggests that routine screening for movement-related fear may be relevant in comprehensive SCD care. The Tampa Scale for Kinesiophobia, utilized in this study, offers a brief, validated assessment tool that could be readily integrated into clinic workflows. Identifying patients with elevated kinesiophobia may help identify a potentially modifiable clinical factor for targeted intervention before maladaptive patterns become entrenched.

Our findings suggest that interventions addressing kinesiophobia in SCD may be relevant for somatic symptom burden; however, the present findings do not establish whether changes in kinesiophobia would directly contribute to changes in somatization. Cognitive-behavioral interventions, including graded exposure therapy and activity pacing, have demonstrated efficacy in reducing kinesiophobia and improving function in other chronic pain populations (Kang et al., 2025). Adapting these approaches for SCD would require careful consideration of the legitimate risks associated with certain activities (e.g., cold exposure, dehydration during exercise) while helping patients differentiate appropriate caution from excessive avoidance. Physical therapy approaches emphasizing gradual, supervised activity progression combined with pain neuroscience education may support patients in rebuilding confidence in movement while developing an accurate understanding of their body's capabilities and limitations (Sánchez-Robalino et al., 2025).

The specificity of the kinesiophobia-somatization relationship may suggest that interventions targeting fear-related arousal and interoceptive processing, rather than implementing broad anxiety reduction approaches, may be promising targets for intervention. Techniques such as interoceptive exposure, wherein individuals learn to tolerate physiological arousal sensations without catastrophic interpretation, may prove particularly valuable. Similarly, mindfulness-based interventions that cultivate non-judgmental awareness (Snell, 2025) of bodily sensations may help patients distinguish genuine disease symptoms from anxiety-related arousal, reducing unnecessary healthcare utilization and improving quality of life.

Several limitations warrant consideration. The cross-sectional design precludes causal inference; longitudinal investigations are necessary to determine whether kinesiophobia temporally precedes somatization increases or whether the relationship is bidirectional. Reliance on self-report measures introduces potential bias, though this concern is partially mitigated by our use of well-validated instruments with established psychometric properties. Our sample size, while representing a substantial proportion of the regional SCD population at the time of data collection, may have limited statistical power to detect smaller effect sizes, particularly for the anxiety and phobia

models. This association should be examined in future studies with larger samples.

Our study did not assess pain catastrophizing, disease severity markers, or healthcare utilization patterns, limiting our ability to contextualize kinesiophobia within the broader clinical picture. Future investigations should incorporate these variables alongside physiological measures of autonomic arousal to more comprehensively characterize the mechanisms linking kinesiophobia to somatization.

5. Conclusion

This investigation provides novel evidence that kinesiophobia is differentially associated with somatization rather than a marker of generalized psychopathology in adults with SCD. This specificity suggests that movement-related fear may be related to psychophysiological mechanisms involving interoceptive hypervigilance, fear-related autonomic arousal, and catastrophic interpretation of bodily sensations. The clinical significance of these findings extends beyond SCD, offering a framework for understanding how disease-specific fears may be associated with increased somatic symptom expression across chronic illness populations.

Future research should pursue several directions. Longitudinal studies are needed to establish temporal precedence and identify trajectories of kinesiophobia development across the disease course. Intervention studies testing adapted cognitive-behavioral and physical therapy approaches for reducing kinesiophobia in SCD would provide critical translational data. Psychophysiological investigations incorporating heart rate variability, cortisol assessment, and neuroimaging could elucidate the biological mechanisms linking movement-related fear to somatization. Extending this research to other chronic pain populations, particularly those involving unpredictable pain episodes (e.g., inflammatory bowel disease, interstitial cystitis), would clarify the generalizability of our findings.

Addressing kinesiophobia may represent a promising avenue for future research aimed at reducing symptom burden and improving quality of life in SCD. Future research targeting the psychological amplification of somatic symptoms through fear reduction may help determine whether these approaches improve function for individuals with SCD while respecting the legitimate disease management concerns that make kinesiophobia an understandable, if ultimately maladaptive, response to living with this challenging condition.

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