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Fatigue and kinesiophobia in axial spondyloarthritis: Exploring the role of disease activity, functional impairment, and psychological factors

Aksiyel spondiloartritte yorgunluk ve kinezyofobi: Hastalık aktivitesi, fonksiyonel bozulma ve psikolojik faktörlerin rolünün incelenmesi

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Abstract

Objective: Fatigue and kinesiophobia are common in axial spondyloarthritis (axSpA) and may be influenced by disease activity, functional impairment, quality of life (QoL), and psychological factors. This study aimed to determine the prevalence of fatigue and kinesiophobia in patients with axSpA and to evaluate their associations with disease activity, functional status, QoL, and psychological variables.

Methods: This cross-sectional study involved 134 patients with axSpA. Fatigue was assessed using the fatigue severity scale, and kinesiophobia was evaluated with the tampa kinesiophobia scale (TKS). At the same time, anxiety and depression were assessed using the hospital anxiety and depression scale. Structural equation modeling (SEM) was used to evaluate the mediating role of fatigue in the effect of anxiety and depression on kinesiophobia.

Results: The mean age of the 134 patients was 38.3±10.4 years. Fatigue was observed in 60.6% of patients and kinesiophobia in 53.3%. Fatigue was more common among women, patients with higher body mass index, comorbidities, and those on non-steroidal anti-inflammatory drugs (NSAIDs). Patients with fatigue had higher disease activity, worse functional status, and reduced spinal mobility compared to those without fatigue. In multivariate analysis, QoL [odds ratio (OR)=1.36, 95% confidence interval (CI): 1.20-1.53] and erythrocyte sedimentation rate (OR=1.12, 95% CI: 1.00-1.26) were identified as independent predictors of fatigue. TKS score were moderately correlated with several measures of disease activity, functional impairment, and QoL. In multivariate analysis, QoL, anxiety, and NSAIDs use were independent predictors of kinesiophobia. SEM analysis showed that fatigue partially mediated the effects of anxiety on kinesiophobia, highlighting the contribution of psychological distress in movement-avoidance behavior.

Özet

Amaç: Yorgunluk ve kinezyofobi, aksiyel spondiloartrit (axSpA) hastalarında yaygın olup ve hastalık aktivitesi, fonksiyonel bozulma, yaşam kalitesi ve psikolojik faktörlerden etkilenebilir. Bu çalışmanın amacı, axSpA'lı hastalarda yorgunluk ve kinezyofobi sıklığını belirlemek ve bu durumların hastalık aktivitesi, fonksiyonel durum, yaşam kalitesi ve psikolojik faktörlerle ilişkisini değerlendirmektir.

Yöntem: Bu kesitsel çalışmaya 134 axSpA hastası dahil edildi. Yorgunluk, yorgunluk şiddeti ölçeği ile ölçüldü ve kinezyofobi tampa kinezyofobi ölçeği (TKS) ile değerlendirildi. Aynı zamanda, anksiyete ve depresyon düzeyleri de hastane anksiyete ve depresyon ölçeği ile değerlendirildi. Anksiyete ve depresyonun kinezyofobi üzerindeki etkisinde yorgunluğun aracılık rolünü değerlendirmek için yapısal eşitlik modeli (SEM) kullanılmıştır.

Bulgular: Çalışmaya dahil edilen 134 axSpA hastasının ortalama yaşı 38,3±10,4 yıldı. Hastaların %60,6'sında yorgunluk, %53,3'ünde ise kinezyofobi gözlendi. Yorgunluk, kadınlarda, vücut kitle indeksi daha yüksek olanlarda, ek hastalığı (komorbiditesi) bulunanlarda ve non-steroid anti-enflamatuvar ilaç (NSAİİ) kullananlarda daha sık görüldü. Yorgunluk bildiren hastalar, bildirmeyenlere kıyasla daha yüksek hastalık aktivitesi, daha kötü fonksiyonel durum ve azalmış spinal mobilite gösteriyordu. Çok değişkenli analizde, yaşam kalitesi [olasılık oranı (OR)=1,36; %95 güven aralığı (GA): 1,20-1,53] ve eritrosit sedimentasyon hızı (OR=1,12; %95 GA: 1,00-1,26) yorgunluğun bağımsız belirleyicileri olarak saptandı. TKS puanı, hastalık aktivitesi, fonksiyonel bozulma ve yaşam kalitesi ile orta düzeyde koreleydi. Çok değişkenli analizde, yaşam kalitesi, anksiyete ve NSAİİ kullanımı kinezyofobinin bağımsız belirleyicileri olarak kaldı. SEM analizi, yorgunluğun anksiyete ile kinezyofobi arasındaki ilişkiyi kısmen aracıladığını ortaya koydu.

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Abstract

Conclusion: Fatigue and kinesiophobia are highly prevalent in axSpA and are closely linked to disease burden and emotional distress. These findings underscore the importance of addressing psychological factors to improve functional outcomes in axSpA.

Keywords: Axial spondyloarthritis, anxiety, depression, fatigue, quality of life, kinesiophobia

Öz

Sonuç: Yorgunluk ve kinezyofobi, axSpA'da oldukça yaygındır ve hastalık yükü ile duygusal sıkıntı ile yakından ilişkilidir. Bulgularımız, yalnızca inflamasyonun kontrol altına alınmasının yeterli olmadığını ve axSpA'da yorgunluk ile kinezyofobiyi azaltmak için psikolojik sıkıntıların da ele alınmasının gerekli olduğunu vurgulamaktadır.

Anahtar Kelimeler: Aksiyel spondiloartrit, anksiyete, depresyon, yorgunluk, yaşam kalitesi, kinezyofobi

Introduction

Axial spondyloarthritis (axSpA) is a common inflammatory rheumatic disease that primarily affects the axial skeleton, leading to inflammatory lower back pain and structural and functional impairments, substantially reducing the quality of life (QoL). AxSpA significantly affects both physical and psychological well-being. In patients with axSpA, increased fear of movement (kinesiophobia) secondary to pain and secondary mood disorders cause pain to be felt more. These psychological conditions can intensify the perception of pain, creating a vicious cycle of physical and mental distress. Cluster analyses reveal that depression is one of the most common comorbidities in axSpA, alongside anxiety, both of which correlate with poorer health outcomes and more severe disease symptoms.[1] More than half of patients with axSpA experience fatigue, with poorer QoL being associated with more fatigue.[2]

To assess disease activity and functional impairment in axSpA, the bath ankylosing spondylitis disease activity index (BASDAI) and the bath ankylosing spondylitis functional index (BASFI) are widely used.[3] These indices, however, include subjective measures such as morning stiffness, pain, and fatigue symptoms that psychological factors like anxiety and depression can heavily influence. Fatigue, in particular, is a critical component of the BASDAI and has been shown to significantly affect disease activity scores and influence treatment decisions. It is one of the most debilitating symptoms reported by axSpA patients, often persisting despite therapeutic advances. Reddy et al.[4] found that nearly one-third of axSpA patients exhibit clinically significant anxiety and depression, with younger age at disease onset, higher disease activity, sleep disturbances, fatigue, lower QoL, and reduced work productivity being significant contributing factors.

Psychological factors, such as anxiety and depression, can further exacerbate the disease burden in axSpA, influencing both the perception of pain and overall disease progression. The relationship between fatigue and psychological factors in axSpA has been highlighted in several studies. Fatigue is often linked to demographic factors such as age, female gender, ethnicity, higher body mass index (BMI), and lower socioeconomic status.[5-7] While the introduction of biological treatments such as tumor necrosis factor-alpha (TNF-α) inhibitors has led to significant improvements in disease management, including reductions in inflammation and pain, the persistence of fatigue in a substantial proportion of patients remains a challenge. Bedaiwi et al.[8] demonstrated that although TNF-α inhibitors effectively reduce fatigue in many patients, many continue to experience severe fatigue post-treatment. Similarly, Bixio et al.[9] found that 44.5% of axSpA patients reported fatigue despite being on effective treatment.

Given these complexities, the 2023 European Alliance of Associations for Rheumatology recommendations for managing axSpA emphasize a comprehensive approach that integrates pharmacological treatments with physical and psychoeducational interventions. These guidelines suggest the use of anti-inflammatory therapies, such as non-steroidal anti-inflammatory drugs (NSAIDs), disease modifying antirheumatic drugs, and biologics, including TNF-α inhibitors, interleukin-17, and Janus tyrosine kinase inhibitors, in combination with tailored non-pharmacological interventions. Addressing psychological factors, particularly anxiety and depression, is critical for breaking the cycle of physical and emotional suffering in axSpA patients.[10]

The primary objective of this cross-sectional study was to assess the prevalence of fatigue and kinesiophobia in patients with axSpA and their association with disease activity and QoL. The secondary objective was to explore the relationship between psychological factors, particularly anxiety and depression, with fatigue and kinesiophobia.

Materials and Methods

Study Design and Participants

This observational cross-sectional study was conducted at the rheumatology outpatient clinic between March 2024 and June 2024. Patients between the ages of 18 and 65 years diagnosed with ankylosing spondylitis (AS) according to the modified New York Criteria[11] and axSpA meeting

the Assessment of SpondyloArthritis International Society classification criteria were included in the study.[12] A total of 134 patients with axSpA participated in the study. All questionnaires were self-administered by patients in a quiet, private setting at the clinic. To ensure data accuracy, patients were instructed to complete each questionnaire, and staff members verified the completeness of responses before submission. Trained staff were available to assist patients if needed. Completed questionnaires were reviewed for missing or inconsistent responses, and any discrepancies were resolved through direct communication with the patient. The timing of all assessments (clinical evaluations, laboratory measurements, and psychological assessments) was synchronized to occur at a single visit.

Data Collection

Disease activity was assessed using the BASDAI and AS disease activity score with C-reactive protein (ASDAS-CRP), functional status using the BASFI, spinal mobility using the Bath AS metrology index (BASMI), and QoL using the AS quality of life questionnaire (ASQoL). Weight and height were measured, and BMI was calculated. Duration of disease (years), symptom duration, age of diagnosis, acute phase reactants [the erythrocyte sedimentation rate (ESR), CRP mg/dL], and human leukocyte antigen (HLA)-B27 status were recorded.[13]

Comorbidity data and current medication were collected through a combination of medical history review and patient reported questionnaires. Fibromyalgia was diagnosed based on the 2016 revision of the American College of Rheumatology criteria, which requires the presence of generalized pain in at least four offive regions, a symptom severity score, and symptoms persisting for at least three months.[14]

Leeds enthesitis index (LEI) score was used for enthesial involvement. The LEI was initially developed to assess enthesitis in psoriatic arthritis. However, its application has been extended to other forms of spondyloarthritis, including axSpA, due to its simplicity and relevance to commonly affected enthesitis sites in axSpA.[15] Scores greater than or equal to one enthesitis were considered present. The BASMI was used to assess spinal mobility in patients with AS. It consists of five physical measurements: cervical rotation, tragus-to-wall distance, lateral lumbar flexion, modified Schober's test, and intermalleolar distance. Cervical rotation measures the degree of neck rotation, while tragus-to-wall distance assesses the distance between the ear tragus and the wall when standing. Lateral lumbar flexion measures the bending distance at the waist, modified Schober's test reflects lumbar spine flexibility during forward flexion, and intermalleolar distance measures the distance between the ankles during maximal hip abduction. For cervical rotation, lumbar side flexion, and tragus-to-wall distance, the mean of the left and right measurements was taken, and all scores were converted according to the BASMI 10 scoring system.[16] Each test is scored from 0 to 10, with higher scores indicating more significant mobility impairment. The overall BASMI score is the average of the five individual scores.[17]

ASDAS-CRP score was calculated. The interpretation of the cut-off values for these two measures is <1.3 for "inactive disease", 1.3 to 2 for "low activity", 2.1 to 3.5 for "high activity", and >3.5 for "very high activity".[18] ASQoL is a validated and reliable tool widely used to measure patients' QoL with AS. It consists of 18 questions covering several aspects of daily life, such as mobility, self-care, and social participation.[19]

Psychological Assessment Protocols

Anxiety and depression were assessed using the hospital anxiety and depression scale (HADS), a tool that measures both anxiety and depression symptoms. Symptoms of anxiety and depression were categorized as moderate-severe (≥11), mild (8-10), and none (<8).[20] The fatigue severity scale (FSS) indices were used for fatigue assessment. This scale is designed to measure the severity of fatigue and its impact on daily activities. The FSS is a validated and reliable tool with nine items rated on a 7-point scale. The total FSS score ranges from 9 to 63, but the final score is expressed as the mean (1 to 7) of all items. Higher scores indicate more severe fatigue and a score of ≥4 suggests the presence of fatigue.[21]

The tampa scale for kinesiophobia (TSK) was used to assess kinesiophobia in patients. This scale consists of 17 items, with a four-point Likert scale ranging from 1 (I fully disagree) to 4 (I fully agree). Higher scores reflect greater levels of kinesiophobia. A score of >37 was classified as high kinesiophobia. In contrast, a score of ≤37 was classified as low kinesiophobia.[22] The Turkish versions of the FSS, TKS, and HADS used in this study have been previously validated for reliability and cultural relevance in the Turkish population.[21-23]

Statistical Analysis

The statistical analysis was conducted using both SPSS version 25 and lavaan in R to support a combination of traditional statistical tests and structural equation modeling (SEM). The normality of quantitative variables was assessed using the Shapiro-Wilk and Kolmogorov-Smirnov tests. Variables with a normal distribution are presented as mean ± standard deviation (SD), while those with a non-normal

distribution are presented as median [interquartile range (IQR)]. The Mann-Whitney U test was used for comparisons between two groups of continuous variables, and the chi-square or Fisher's exact test was performed to compare categorical variables. The relationships between different variables were analyzed using the Spearman correlation test. Backward stepwise regression analyses were conducted to investigate which factors are associated with fatigue and kinesiophobia.

Subsequently, SEM was used to evaluate mediation pathways between anxiety, depression, fatigue, and kinesiophobia. The SEM model was built with maximum likelihood (ML) estimation. Indirect effects were calculated, and total effects were assessed for both anxiety and depression.

Post-hoc power analysis for the study's sample size was performed using G*Power 3.1.9.2 software. Fatigue was chosen for post-hoc analysis using the independent samples t-test. The study's power was sufficient (1-β>95%, α=0.05; d=1.20; df=130).

Ethical Approval

The Bingöl University Health Sciences Scientific Research and Publication Ethics Committee obtained the study's ethical approval (date of approval: 07.05.2024, number: 24/10). Written informed consent was obtained from all participants before study enrollment. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Results

A total of 134 patients with axSpA were included in the study. The mean age was 38.3±10.4 years, and the mean BMI was 26.6±4.3 kg/m². The median symptom duration was 7 years (IQR 8), and the median disease duration was 6 years (IQR 8). Of the participants, 50.7% were male, and 42.5% were current smokers. At least one comorbidity was present in 28.4% of patients, with depression being the most common comorbidity (16%), followed by hypertension (5.2%) and thyroid disease (4.5%). The median ESR was 8 mm/h (IQR 6), and the median CRP level was 4.2 mg/L (IQR 6.9). The mean hemoglobin level was 14.2±1.7 g/dL (Table 1).

Patients receiving biological therapy (50.7%) were older, had longer disease duration, and were more likely to have radiographic axSpA and HLA-B27 positivity compared to those not receiving biologics. Current smoking was less common among biologic users, and anterior uveitis was observed exclusively in this group. Despite these differences, there were no significant between-group differences in disease activity (BASDAI), functional status (BASFI), anxiety, depression, or kinesiophobia. However, fatigue prevalence was slightly higher among patients not receiving biological therapy (68.2% vs. 51.5%, p=0.049).

Fatigue Analysis

Clinically relevant fatigue (FSS ≥4) was observed in 60.6% of axSpA patients. Fatigue was more common in women (76.5%) than in men (42.4%) (p<0.001). The patients with fatigue had a higher mean BMI (27.6±5.1 vs.

Table 1 . Demographic, clinical and disease activity characteristics of axSpA patients

Variables	n=134	Variables	n=134
Sex, male, n (%)	68 (50.7)	ESR mm/h, median (IQR)	8 (6)
Age, years, mean ± SD	38.3 (10.4)	CRP mg/L, median (IQR)	4.2 (6.9)
Current smoker, n (%)	57 (42.5)	Hb mg/L, mean ± SD	14.2 (1.7)
Currently employed, n (%)	74 (55.6)	History of anterior uveitis, n (%)	9 (6.7)
Symptom duration, years, median (IQR)	7 (8)	BASDAI, mean ± SD	4.3 (2.1)
Disease duration, years, median (IQR)	6 (8)	BASFI, mean ± SD	2.9 (2.3)
AxSpA type, r-axSpA, n (%)	81 (60.4)	ASDAS-CRP, mean ± SD	2.6 (0.9)
HLA-B27 positive, n (%)	45 (47.4)	ASQoL, mean ± SD	7.9 (5.4)
BMI, kg/m², mean ± SD	26.6±4.3	LEI ≥1, n (%)	40 (30.3)
Comorbidity, at least one, n (%)	38 (28.4)	BASMI, median (IQR)	3.29 (1.45)
Fibromyalgia, n (%)	12 (9)	Fatigue, n (%)	80 (59.7)
Spondyloarthritis family history, n (%)	40 (29.9)	Kinesiophobia, n (%)	65 (53.3)
NSAID, n (%)	101 (75.4)	HADS anxiety, n (%)	27 (20.1)
Biological therapy, n (%)	68 (50.7)	HADS depression, n (%)	22 (16.4)

AxSpA: Axial spondyloarthritis, ASDAS-CRP: Ankylosing spondylitis disease activity score with C-reactive protein, ASQoL: Ankylosing spondylitis quality of life questionnaire, BASDAI: Bath ankylosing spondylitis disease activity index, BASFI: Bath ankylosing spondylitis functional index, BASMI: Bath ankylosing spondylitis metrology index, BMI: Body mass index, cm: Centimeters, ESR: Erythrocyte sedimentation rate, Hb: Hemoglobin, HLA: Human leukocyte antigen, IQR: Interquartile range, LEI: Leeds enthesitis index, r-axSpA: Radiographic axial spondyloarthritis, SD: Standard deviation

25.2±3.3, p=0.002) and more frequent comorbidities (37.5% vs. 14.8%, p=0.004). Fibromyalgia was more common in patients with fatigue (13.8% vs. 1.9%, p=0.027), and they had significantly lower hemoglobin levels (13.8±1.74 g/dL vs. 14.7±1.47 g/dL, p=0.001). ESR was higher in patients with fatigue (median 9 mm/h vs. 7.5 mm/h, p=0.010), whereas CRP levels were similar between the two groups. No significant differences were observed in symptom duration, disease duration, or HLA-B27 positivity between patients with and without fatigue. Fatigue was more prevalent in without biological therapy and less frequent in patients on biological therapy, though the difference was not statistically significant (p=0.066). No significant differences were found in peripheral arthritis, uveitis, enthesitis, family SpA history, or joint limitations. Anxiety (30% vs. 5.6%, p=0.001) and depression (26.3% vs. 1.9%, p=0.009) were significantly more prevalent in patients with fatigue (Table 2).

The patients with fatigue also exhibited higher disease activity and worse functional impairment. BASMI scores indicated reduced spinal mobility in patients with fatigue (median 3.4 vs. 3, p=0.030). FSS scores showed moderate to strong correlations with disease activity, functional impairment, and quality of life. Specifically, significant correlations were observed with BASDAI (r=0.592), BASFI (r=0.631), ASQoL (r=0.701), and ASDAS-CRP (r=0.455), all p-values <0.001. Weak but significant correlations were noted with BASMI total scores (r=0.271, p=0.002) and lateral lumbar flexion (r=0.234, p=0.009). Additionally, FSS scores were weakly correlated with BMI (r=0.231, p=0.007) and hemoglobin levels (r=-0.255, p=0.003), while no significant correlation was found with ESR or CRP. Strong correlations with HADS anxiety (r=0.552) and HADS depression (r=0.457) further highlight the psychological impact on fatigue (p-values <0.001) (Figure 1).

In the univariate analysis, several factors were significantly associated with fatigue, including sex, BMI, ASQoL, BASDAI, BASFI, fibromyalgia, ESR, and the presence of anxiety, depression, and kinesiophobia. In the multivariate analysis, ASQoL (OR=1.406, 95% CI: 1.233-1.604, p<0.001) and ESR (OR=1.117, 95% CI: 1.001-1.264, p=0.048) were identified as independent factors associated with fatigue (Table 3).

Kinesiophobia Analysis

Kinesiophobia analysis was based on 122 patients for whom complete TSK data were available. Among them, 65 (53.3%) were classified as having kinesiophobia. Patients with kinesiophobia had significantly higher disease activity and worse functional outcomes. BASMI scores were marginally higher in patients with kinesiophobia. Anxiety, depression, and fatigue were also significantly more prevalent in patients with kinesiophobia (Table 4). TKS scores showed moderate significant correlations with BASDAI (r=0.367), ASDAS-CRP (r=0.368), BASFI (r=0.364), and ASQoL (r=0.519), all p-values <0.001. Weak but significant correlations were noted between kinesiophobia and BASMI scores (r=0.186, p=0.048), lateral lumbar flexion (r=-0.257, p=0.006), and intermalleolar distance (r=-0.268, p=0.004) (Figure 1).

Table 2. Comparison of disease characteristics, activity, functionality, comorbidity, depression, and anxiety in axSpA patients with and without fatigue

Variables	With fatigue (n=80)	Without fatigue (n=54)	p-value
Sex, female, n (%)	52 (65)	16 (29.6)	**<0.001**
Age, years, mean ± SD	39.9 (11.5)	37 (8.7)	0.096
Current smoker, n (%)	37 (46.3)	20 (37)	0.290
Currently employed, n (%)	36 (45)	38 (71.7)	**0.002**
Marital status, married, n (%)	62 (79.5)	36 (66.7)	0.158
Symptom duration, years, median (IQR)	6 (8)	10 (7)	0.141
Disease duration, years, median (IQR)	4 (7)	6 (10)	0.201
AxSpA type, r-axSpA, n (%)	45 (56.3)	36 (66.7)	0.226
HLA-B27 positive, n (%)	22 (40)	23 (57.5)	0.092
BMI, kg/m^2, mean ± SD	27.6±5.1	25.2±3.3	**0.002**
At least one comorbidity, n (%)	30 (37.5)	8 (14.8)	**0.004**
Fibromyalgia, n (%)	11 (13.8)	1 (1.9)	**0.027**
Spondyloarthritis family history, n (%)	25 (31.3)	15 (27.8)	0.667
NSAID, n (%)	66 (82.5)	35 (64.8)	**0.020**
Biological therapy, n (%)	35 (44.9)	33 (63.1)	0.066
Swollen joint count, (0-66) median (IQR)	0 (0)	0 (0)	0.094
Tender joint count, (0-68) median (IQR)	0 (2)	0 (1)	0.019
LEI ≥1, n (%)	28 (35.9)	12 (22.2)	0.093
ESR mm/h, median (IQR)	9 (7)	7.5 (4)	**0.010**
CRP mg/L, median (IQR)	3.9 (7.2)	3.93 (6.8)	0.235
Hb mg/L, mean ± SD	13.8±1.74	14.7±1.47	0.001
ASQoL, median (IQR)	2.98 (0.9)	2.27 (0.8)	<**0.001**
BASDAI, mean ± SD	5.19±1.9	3.12±1.9	<**0.001**
ASDAS-CRP, mean ± SD	2.9±0.9	2.2±0.8	<**0.001**
BASFI, mean ± SD	4.01±2.2	1.58±1.7	<**0.001**
BASMI, median (IQR)	3.4 (1.2)	3 (1.6)	**0.030**
Kinesiophobia, n (%)	49 (65.3)	16 (34)	**0.001**
HADS anxiety, n (%)	24 (30)	3 (5.6)	**0.001**
HADS depression, n (%)	21 (26.3)	1 (1.9)	**0.009**

AxSpA: Axial spondyloarthritis, ASDAS-CRP: Ankylosing spondylitis disease activity score with C-reactive protein, ASQoL: Ankylosing spondylitis quality of life questionnaire, BASDAI: Bath ankylosing spondylitis disease activity index, BASFI: Bath ankylosing spondylitis functional index, BASMI: Bath ankylosing spondylitis metrology index, BMI: Body mass index, cm: Centimeters, ESR: Erythrocyte sedimentation rate, HADS: Hospital anxiety and depression scale, Hb: Hemoglobin, HLA: Human leukocyte antigen, LEI: Leeds enthesitis index, SD: Standard deviation, NSAID: Non-steroidal anti-inflammatory drugs, r-axSpA: Radiographic axial spondyloarthritis, TKS: Tampa kinesiophobia scale

Table 3. Evaluation of factors affecting fatigue in unadjusted and multivariable analysis

	Unadjusted analysis			Multivariable analysis (backward stepwise regression)			
Variables	OR	Lower-upper 95% CI	p-value	Odds ratio	Lower 95% CI	Upper 95% CI	p-value
Age, years	1.028	0.993-1.064	0.117				
Sex, female, n (%)	4.441	2.098-9.274	<0.001				
Disease duration, years	0.964	0.910-1.020	0.206				
Body mass index, kg/m²	1.132	1.037-1.236	0.006				
ASQol	1.398	1.252-1.561	<0.001	1.361	1.208	1.533	**<0.001**
BASDAI, active disease	6.988	3.231-15.112	<0.001				
BASFI	1.841	1.456-2.329	<0.001				
BASMI	1.248	0.959-1.624	0.099				
ASDAS, active disease	3.678	1.693-7.792	0.001				
ESR, mm/h	1.131	1.042-1.227	0.003	1.117	1.001	1.264	**0.048**
CRP, mg/L	1.041	0.985-1.099	0.151				
Hb, mg/L	0.693	0.550-0.874	0.002				
Depression, present	18.864	2.453-145.092	0.005	8.731	.887	85.986	0.063
Anxiety, present	7.286	2.069-25.653	0.002				
Kinesiophobia, present	3.651	1.694-7.872	0.001				
At least one comorbidity	3.450	1.436-8.290	0.006				
Fibromyalgia, present	8.449	1.057-67.509	0.044				
NSAID, yes/no	2.559	1.147-5.712	0.022				
Biological therapy, yes/no	0.495	0.245-1.000	0.050				

ASDAS-CRP: Ankylosing spondylitis disease activity score with C-reactive protein, ASQoL: Ankylosing spondylitis quality of life questionnaire, BASDAI: Bath ankylosing spondylitis disease activity index, BASFI: Bath ankylosing spondylitis functional index, BASMI: Bath ankylosing spondylitis metrology index, BMI: Body mass index, CI: Confidence interval, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, HADS: Hospital anxiety and depression scale, Hb: Hemoglobin, NSAID: Non-steroidal anti-inflammatory drugs, OR: Odds ratio

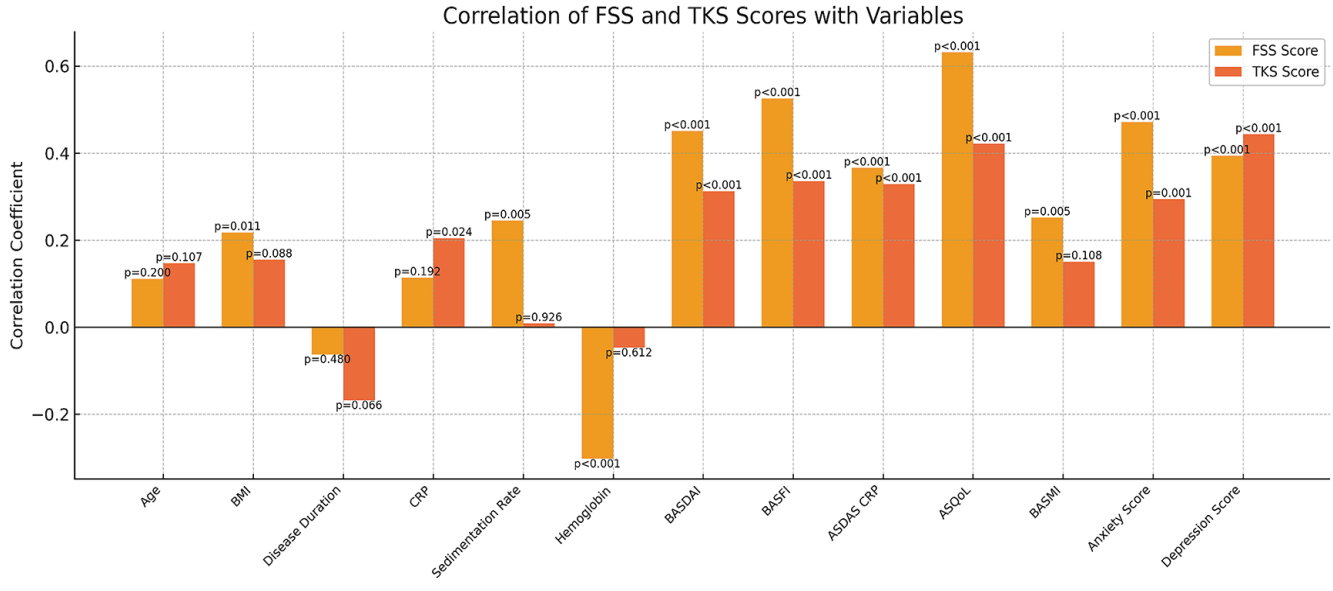

Figure 1. Pearson correlation analysis between FSS and TSK scores and clinical variables in axial spondyloarthritis
This heatmap illustrates the strength and direction of correlations between fatigue (FSS) and kinesiophobia (TSK) scores and a range of clinical and psychosocial parameters, including disease activity indices (BASDAI, ASDAS-CRP), functional impairment (BASFI), spinal mobility (BASMI), quality of life (ASQoL), acute phase reactants (CRP, ESR), hemoglobin levels, body mass index (BMI), anxiety, and depression scores (HADS). Significant associations (p<0.05) are visually indicated

ASDAS-CRP: Ankylosing spondylitis disease activity score with C-reactive protein, ASQoL: Ankylosing spondylitis quality of life questionnaire, BASDAI: Bath ankylosing spondylitis disease activity index, BASFI: Bath ankylosing spondylitis functional index, BASMI: Bath ankylosing spondylitis metrology index, BMI: Body mass index, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, FSS: Fatigue severity scale, HADS: Hospital anxiety and depression scale, TSK: Tampa scale for kinesiophobia

For kinesiophobia, the univariate analysis identified disease duration, BASDAI, BASFI, ASQoL, depression, anxiety, and NSAID use as significant factors. In the multivariate analysis, ASQoL (OR=1.130, 95% CI: 1.022-1.250, p=0.017), anxiety (OR=7.139, 95% CI: 1.538-33.132, p=0.012), and NSAID use (OR=3.204, 95% CI: 1.029-9.981, p=0.045) were identified as independent factors associated with kinesiophobia (Table 5).

Table 4. Comparison of disease characteristics, activity, functionality, comorbidity, depression, and anxiety in axSpA patients with and without kinesiophobia

Variables	With kinesiophobia (n=65)	Without kinesiophobia (n=57)	p
Sex, female, n (%)	34 (52.3)	28 (49.1)	0.726
Age, years, mean ± SD	40.5±11.8	37.1±8.7	0.070
Current smoker, n (%)	30 (46.2)	24 (42.1)	0.653
Symptom duration, years, median (IQR)	6 (6)	8 (8)	0.254
Disease duration, years, median (IQR)	4 (7)	6 (8)	0.276
AS type, r-axSpA, n (%)	36 (55.4)	37 (64.9)	0.284
BMI, kg/m^2, mean ± SD	27.4±5.1	25.9±4.3	0.096
At least one comorbidity, n (%)	23 (35)	12 (21.1)	0.081
NSAID n (%)	57 (87.7)	35 (61.4)	**0.001**
Biological therapy, n (%)	31 (47.7)	30 (52.6)	0.586
Swollen joint count, (0-66) median (IQR)	0 (0)	0 (0)	0.096
Tender joint count, (0-68) median (IQR)	0 (2)	0 (1)	0.126
LEI >1, n (%)	27 (35.5)	12 (22.2)	0.103
ESR mm/h, median (IQR)	9 (7)	8.5 (6)	0.961
CRP mg/L, median (IQR)	5.2 (8.8)	3.58 (5.9)	0.100
Hb mg/L, mean ± SD	13.9±1.7	14.8±1.5	0.588
ASQoL, median (IQR)	10 (9)	4 (8)	<**0.001**
BASDAI, mean ± SD	5.13±1.9	3.12±1.9	**0.001**
ASDAS-CRP, mean ± SD	3.01±0.9	2.37±0.9	**0.001**
BASFI, mean ± SD	3.96±2.2	1.55±1.7	**0.002**
BASMI, median (IQR)	3.3 (1.2)	3.1 (1.7)	**0.038**
Cervical rotation, cm, mean ± SD	64.3±14.2	65.1±17.5	0.778
Tragus-to-wall distance, cm, mean ± SD	16.6±3.2	17.1±5.3	0.635
Lateral lumbar flexion, cm, mean ± SD	13.9±5.2	16.2±10.1	0.123
Modified Schober's test, cm, mean ± SD	4.3±1.4	4.3±1.8	0.974
Intermalleolar distance, cm, mean ± SD	94.2±15.9	100.4±18.3	0.056
Fatigue, n (%)	49 (75.4)	26 (45.6)	**0.001**
HADS anxiety, n (%)	21 (32.3)	4 (7)	**0.001**
HADS depression, n (%)	17 (26.2)	4 (7)	**0.005**

ASDAS-CRP: Ankylosing spondylitis disease activity score with C-reactive protein, ASQoL: Ankylosing spondylitis quality of life questionnaire, BASDAI: Bath ankylosing spondylitis disease activity index, BASFI: Bath ankylosing spondylitis functional index, BASMI: Bath Ankylosing spondylitis metrology index, BMI: Body mass index, CRP: C-reactive protein, HADS: Hospital anxiety and depression scale, Hb: Hemoglobin, IQR: Interquartile range, LEI: Leeds enthesitis index, NSAID: Non-steroidal anti-inflammatory drugs, ESR: Erythrocyte sedimentation rate, r-axSpA: Radiographic axial spondyloarthritis, SD: Standard deviation

Anxiety and Depression

Patients with anxiety or depression showed significantly worse clinical and functional outcomes compared to those without these symptoms. Anxiety and depression were more frequent in patients with higher disease activity, worse functional impairment, lower quality of life, and more significant physical and psychological symptom burden, including fatigue and kinesiophobia. Depression was linked to higher BMI, more comorbidities, and NSAID use (Supplementary Tables 1 and 2).

A mediation analysis was conducted using SEM with the ML estimator on a sample of 120 participants. The model demonstrated an excellent fit to the data. The parameter estimates showed that anxiety had a significant effect on fatigue (β=1.844, SE=0.390, p<0.001), while depression had a marginal effect (β=0.795, SE=0.426, p=0.062). Fatigue, in turn, had a strong direct effect on kinesiophobia (β=0.151, SE=0.042, p<0.001). Depression also directly influenced kinesiophobia with a substantial effect (β=0.703, SE=0.198, p<0.001), whereas anxiety's direct effect on kinesiophobia was not significant (β=0.078, SE=0.194, p=0.689). The analysis further revealed a significant indirect effect of anxiety on kinesiophobia through fatigue (β=0.278, SE=0.097, p=0.004), while the indirect effect of depression on kinesiophobia was not statistically significant (β=0.120, SE=0.072, p=0.098). The total effect of anxiety on kinesiophobia was marginally significant (β=0.356, SE=0.188, p=0.058), whereas the total effect of depression was strongly significant (β=0.823, SE=0.205, p<0.001).

The model explained 31.2% of the variance in fatigue and 33.6% of the variance in kinesiophobia, suggesting that psychological factors such as anxiety and depression play a crucial role in shaping physical outcomes. These findings highlight the mediating role of fatigue in the relationship between psychological distress and movement-related fear, emphasizing the interconnected nature of mental and physical health (Figure 2).

Discussion

Our study highlights the complex and multifaceted nature of fatigue and kinesiophobia in axSpA, emphasizing their strong associations with both physical and psychological factors. Fatigue was present in 60.6% of patients, with multivariate analysis identifying ASQoL and ESR as independent predictors. Patients experiencing fatigue exhibited higher disease activity, greater functional impairment, elevated BMI, increased ESR, more frequent

Table 5. Evaluation of factors affecting kinesiophobia in multivariable analysis

	Unadjusted analysis				Multivariable analysis (backward stepwise regression)			
Variables	OR	Lower 95% CI	Upper 95% CI	p	OR	Lower 95% CI	Upper 95% CI	p
Age, years	1.033	0.997	1070	0.730	1.046	0.998	1.097	0.062
Sex, female vs. male	1.136	0.558	2.315	0.726	0.422	0.151	1.077	0.099
Body mass index, kg/m^2	1.069	0.997	1.106	0.100				
Disease duration, years	0.947	0.888	1.009	0.096				
BASDAI-active disease	1.354	1.131	1.620	0.001				
BASFI	1.278	1.085	1.505	0.003				
ASQoL	1.187	1.1098	1.282	<0.001	1.130	1.022	1.250	**0.017**
BASMI	1.083	0.838	1.400	0.543				
ASDAS- active disease	3.212	1.418	7.278	0.005				
ESR, mm/h	0.992	0.950	1.035	0.700				
CRP, mg/L	1.060	0.998	1.126	0.058				
Hemoglobin, mg/L	0.941	0.757	1.170	0.585				
Depression, present	4.693	1.475	14.926	0.009				
Anxiety, present	6.324	2.019	19.803	0.002	6.641	1.492	29.551	**0.013**
At least one comorbidity	2.054	0.090	4.639	0.083				
NSAID, yes/no	4.479	1.799	11.150	0.001	4.449	1.489	13.412	**0.008**
Biological therapy, yes/no	1.219	0.598	2.484	0.586				

ASDAS-CRP: Ankylosing spondylitis disease activity score with C-reactive protein, ASQoL: Ankylosing spondylitis quality of life questionnaire, BASDAI: Bath ankylosing spondylitis disease activity index, BASFI: Bath ankylosing spondylitis functional index, BASMI: Bath ankylosing spondylitis metrology index, BMI: Body mass index, CI: Confidence interval, CRP: C-reactive protein, ESR: Erythrocyte sedimentation rate, Hb: Hemoglobin, NSAID: Non-steroidal anti-inflammatory drugs, OR: Odds ratio

comorbidities, and lower hemoglobin levels. The association between fatigue and elevated ESR may be partly explained by coexisting anemia and low grade chronic inflammation, both of which contribute to systemic fatigue burden more accurately reflected by ESR than CRP.[8] Furthermore, psychological distress, including anxiety, depression, and kinesiophobia, was significantly more common in fatigued patients, underscoring the need for a comprehensive, multidisciplinary approach to management. Similarly, kinesiophobia was observed in 53.3% of patients and was strongly linked to higher disease activity, worse functional outcomes, and increased psychological distress. Multivariate analysis identified ASQoL, anxiety, and NSAID therapy as independent predictors of kinesiophobia, reinforcing the interplay between disease burden and emotional well-being in axSpA. These findings underscore the necessity of addressing both physical and psychological aspects in clinical care to optimize patient outcomes.

Bixio et al.[9] also highlighted the psychological dimension of fatigue, showing that patients with higher fatigue levels had significantly elevated HADS-D scores alongside higher ASDAS, BASFI, and HAQ scores. Their study identified HADS-D as a significant predictor of fatigue. This supports our findings that psychological distress, especially depression, plays a crucial role in contributing to fatigue in patients with axSpA.[7] Although fibromyalgia was associated with fatigue and kinesiophobia in univariate analysis, it did not remain significant in the multivariate model. This may be due to shared pathways with depression and pain-related disease impact. Further studies with larger samples and subgroup analyses are needed to elucidate its independent contribution to fatigue in axSpA.

Effective fatigue management in axSpA should not only aim at controlling disease activity but also prioritize interventions addressing mental health, particularly depression. A study conducted in France found that fatigue was strongly correlated with increased disease activity, which is consistent with our results.[5] The relationship between activity and fatigue may be because our measures of disease activity include fatigue. Increased inflammatory states may also exacerbate fatigue symptoms, possibly through increased cytokine production and immune dysregulation.

A meta-analysis evaluating fatigue in patients with axSpA from different geographies found a pooled prevalence of 56%, and poor QoL was associated with increased fatigue.[2] This relationship between poor QoL and a similar prevalence of fatigue was also found in our study. While previous studies have reported a high prevalence of fatigue in axSpA, our findings add novelty by identifying ESR as an independent predictor. This suggests that persistent inflammatory activity plays a critical role in fatigue, even in patients undergoing advanced treatment. Despite improvements in disease control with biologics, the persistence of fatigue highlights unmet clinical needs.[9]

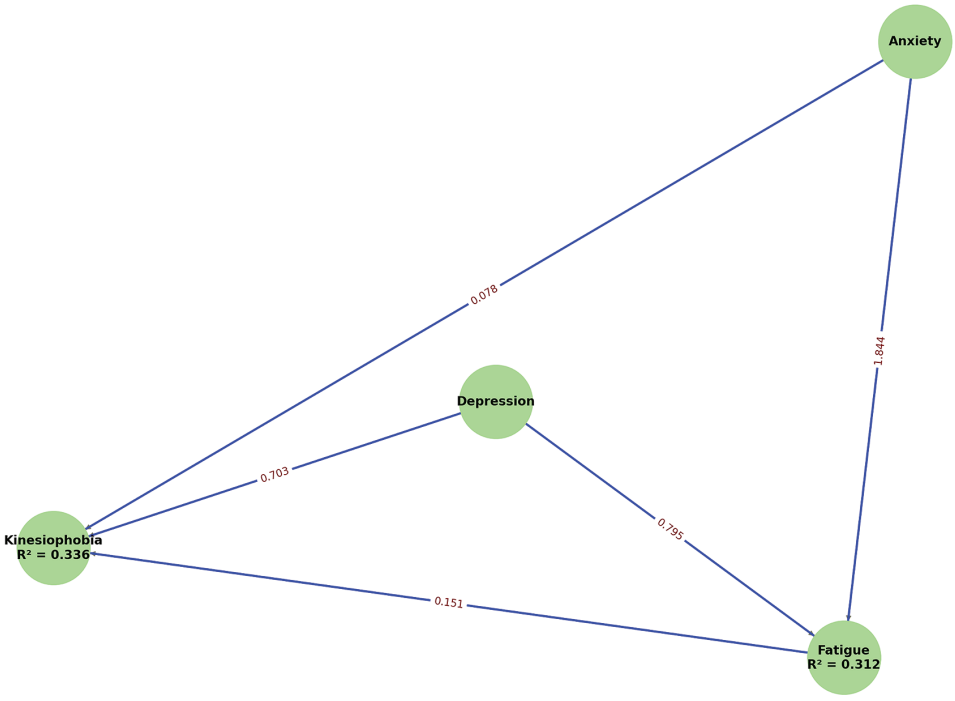

Figure 2. Structural equation model showing the mediating role of fatigue in the relationship between anxiety and kinesiophobia in axial spondyloarthritis The model depicts standardized path coefficients between anxiety, depression, fatigue, and kinesiophobia. Fatigue is shown to partially mediate the relationship between anxiety and kinesiophobia. R^2 values inside each construct represent the proportion of variance explained. Solid arrows represent significant paths ($p<0.05$), and dashed lines represent non-significant associations

Anxiety → Fatigue	(β=1.844, SE=0.390, p<0.001)
Depression → Fatigue	(β=0.795, SE=0.426, p=0.062)
Fatigue → Kinesiophobia	(β=0.151, SE=0.042, p<0.001)
Depression → Kinesiophobia	(β=0.703, SE=0.198, p<0.001)
Anxiety → Kinesiophobia	(β=0.078, SE=0.194, p=0.689)

Reddy et al.[4] reported a high prevalence of anxiety (38%) and depression (36%) among patients with axSpA, with these conditions correlating strongly with younger age at disease onset, elevated disease activity, sleep disturbances, fatigue, and diminished QoL. Similarly, in our study, we found that in patients with anxiety and depression, disease activity, fatigue, and kinesiophobia scores were high, and QoL was poor. Taken together, these findings highlight the intertwined relationship between psychological distress, disease activity, and physical limitations in axSpA, supporting the need for treatment of both psychological and physical symptoms to manage fatigue in these patients.

In a study conducted on AS patients, moderate correlations were observed between kinesiophobia and depression, body awareness and pain catastrophizing and depression, and pain catastrophizing and disease activity.[24] Previous studies, such as those by Oskay et al.,[25] have demonstrated that kinesiophobia negatively impacts QoL in axSpA. Our findings are consistent, highlighting significant correlations between TKS scores, disease activity, QoL, anxiety, and depression. We observed worse disease activity and functional impairment in patients with higher levels of kinesiophobia, though BASMI total scores were higher. However, in another study, no statistically significant relationship was reported between kinesiophobia scores and BASDAI, but there was a weak correlation with BASFI.[25] However, we observed only weak correlations between kinesiophobia and spinal mobility measures, such as BASMI scores and lateral lumbar flexion, contrasting with the stronger associations reported by Er and Angın.[26] These differences may be due to variations in study populations or methodologies. Nevertheless, our results suggest that psychological factors play a more prominent role in kinesiophobia than physical limitations alone.

Our findings demonstrate, for the first time in axSpA, that fatigue mediates the relationship between anxiety and kinesiophobia, reinforcing the hypothesis that psychological distress may amplify physical avoidance behaviors. In our

SEM model, fatigue partially mediated the association between anxiety and kinesiophobia, supporting the role of psychological distress in physical avoidance behaviors. Similarly, Medrado et al.[27] reported that kinesiophobia mediates the relationship between pain and physical dysfunction in inflammatory arthritis, underscoring the psychological dimension. While their study focused on broader inflammatory arthritis, our model provides specific insights into these interactions within the axSpA population, supported by acceptable fit statistics. Our SEM findings emphasize that fatigue and kinesiophobia in axSpA are shaped not only by inflammatory processes but also by psychological distress. These findings support the clinical utility of integrating brief psychological screening (e.g., HADS) into routine care and tailoring interventions such as cognitive-behavioral therapy and physical rehabilitation to address these psychosocial contributors.

In contrast, our multivariate analysis identified ASQoL, anxiety, and NSAID use as independent predictors, suggesting that kinesiophobia in axSpA is not solely driven by physical limitations but also by psychological and treatment-related factors. This highlights the role of fear-avoidance behavior, where anxiety amplifies movement related fears due to pain or disease progression concerns. The association with NSAID use may reflect heightened pain perception or disease activity.These findings underscore the importance of comprehensive management, including gradual physical activity, education on movement safety, and psychological support to address underlying fears and improve functional outcomes. Although NSAID use is not a known driver of fatigue or kinesiophobia, its association in our study may reflect ongoing symptoms in patients who rely solely on NSAIDs due to limited access to or delay in initiating biologic therapy. While biologics are effective in suppressing inflammation, they may not fully address fatigue and kinesiophobia, particularly in patients with irreversible structural damage or comorbid fibromyalgia. These residual symptoms highlight the need for comprehensive symptom management beyond inflammation control.

Study Limitations

Our study has several limitations. First, its cross-sectional design limits our ability to infer causality between fatigue, kinesiophobia, and disease-related factors, underscoring the need for longitudinal research. Second, while our sample size was sufficient for primary analyses, it may have been underpowered to detect smaller associations in specific subgroups. Third, although self-reported measures are essential for capturing subjective experiences such as anxiety, depression, and kinesiophobia, we acknowledge that these tools provide only a screening, not a clinical diagnosis. The absence of formal psychiatric evaluations is a limitation, as definitive diagnoses of anxiety and depression require clinical assessment. Lastly, the lack of a control group restricts our ability to draw broader comparisons with other populations or disease groups.

Conclusion

In conclusion, fatigue and kinesiophobia in axSpA reflect complex interactions between physical and psychological domains. Addressing disease activity, comorbidities, and mental health—especially anxiety and depression may improve outcomes. Multidisciplinary approaches, including psychological support and physical rehabilitation, are essential for managing these burdensome symptoms.

Ethics

Ethics Committee Approval: The Bingöl University Health Sciences Scientific Research and Publication Ethics Committee obtained the study's ethical approval (date of approval: 07.05.2024, number: 24/10).

Informed Consent: Written informed consent was obtained from all participants before study enrollment.

Footnotes

Authorship Contributions

Surgical and Medical Practices: G.A., Concept: G.A., F.S., Design: G.A., F.S., Data Collection and Processing: G.A., F.S., Analysis or Interpretation: G.A., Literature Search: G.A., Writing: G.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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Supplementary Table 1. Demographic, clinical and disease activity characteristics of axSpA patients with and without anxiety

Variables	With anxiety (n=27)	Without anxiety (n=107)	p-value
Sex, male, n (%)	17 (63)	51 (47.7)	0.155
Age, years, mean ± SD	35.1 (9.6)	39.6 (10.6)	0.053
Current smoker, n (%)	13 (48.1)	44 (44.1)	0.509
Currently employed, n (%)	10 (37)	64 (60.4)	**0.029**
Marital status, married, n (%)	62 (79.5)	36 (66.7)	0.158
Symptom duration, years, median (IQR)	6 (7)	8 (8)	0.263
Disease duration, years, median (IQR)	6 (7)	6 (8)	0.984
AxSpA type, r-axSpA, n (%)	12 (44.4)	69 (64.5)	0.057
HLA-B27 positive, n (%)	8 (40)	37 (49.3)	0.458
BMI, kg/m , mean ± SD	28.3±5.4	26.3±4.4	0.091
At least one comorbidity, n (%)	10 (37)	28 (26.2)	0.263
Fibromyalgia, n (%)	7 (25.9)	5 (4.7)	**0.003**
Spondyloarthritis family history, n (%)	7 (25.9)	33 (30.8)	0.618
NSAID, n (%)	22 (81.5)	79 (73.8)	0.410
Biological therapy, n (%)	12 (44.4)	56 (52.3)	0.464
Swollen joint count, (0-66) median (IQR)	0 (0)	0 (0)	0.932
Tender joint count, (0-68) median (IQR)	0 (3)	0 (1)	0.431
LEI ≥1, n (%)	28 (35.9)	12 (22.2)	0.093
ASQoL, median (IQR)	11.9 (4.5)	7.1 (5.3)	<**0.001**
BASDAI, mean ± SD	5.9 (1.9)	3.9 (2.1)	<**0.001**
ASDAS-CRP, mean ± SD	3.3 (0.9)	2.5 (0.9)	<**0.001**
BASFI, mean ± SD	4.01 (2.2)	1.58 (1.7)	<**0.001**
BASMI, median (IQR)	3.1 (1.5)	3 (1.6)	0.223
Kinesiophobia, n (%) n=122	21 (84)	44 (45.4)	**0.001**
Fatigue, n (%)	24 (88.9)	56 (52.3)	**0.001**
HADS depression, n (%)	13 (48.1)	9 (8.4)	<**0.001**

ASDAS-CRP: Ankylosing spondylitis disease activity score with C-reactive protein, ASQoL: Ankylosing spondylitis quality of life questionnaire, BASDAI: Bath ankylosing spondylitis disease activity index, BASFI: Bath ankylosing spondylitis functional index, BASMI: Bath ankylosing spondylitis metrology index, BMI: Body mass index, ESR: Erythrocyte sedimentation rate, HADS: Hospital anxiety and depression scale, Hb: Hemoglobin, HLA: Human leukocyte antigen, IQR: Interquartile range, LEI: Leeds enthesitis index, r-axSpA: Radiographic axial spondyloarthritis, SD: Standard deviation

Supplementary Table 2. Demographic, clinical and disease activity characteristics of axSpA patients with and without depression

Variables	With depression (n=22)	Without depression (n=112)	p-value
Sex, male, n (%)	13 (59.1)	55 (49.1)	0.392
Age, years, mean ± SD	40.6 (10.8)	38.4 (10.4)	0.336
Current smoker, n (%)	10 (45)	47 (42)	0.762
Currently employed, n (%)	10 (45.5)	64 (57.7)	0.293
Marital status, married, n (%)	62 (79.5)	36 (66.7)	0.158
Symptom duration, years, median (IQR)	8 (13)	7 (8)	0.697
Disease duration, years, median (IQR)	6 (12)	6 (6)	0.581
AxSpA type, r-axSpA, n (%)	10 (45.4)	71 (63.4)	0.116
HLA-B27 positive, n (%)	5 (3.3)	40 (50)	0.235
BMI, kg/m^2, mean ± SD	28.9±6.7	26.2±4.4	**0.011**
At least one comorbidity, n (%)	11 (50)	27 (24.1)	**0.014**
Fibromyalgia, n (%)	4 (18.2)	8 (7.1)	0.097
Spondyloarthritis family history, n (%)	7 (31.8)	33 (29.5)	0.825
NSAID, n (%)	21 (95.5)	80 (71.4)	**0.017**
Biological therapy, n (%)	10 (45.5)	58 (51.8)	0.587
Swollen joint count, (0-66) median (IQR)	0 (0)	0 (0)	0.902
Tender joint count, (0-68) median (IQR)	0 (3)	0 (1)	0.431
LEI ≥1, n (%)	28 (35.9)	12 (22.2)	0.093
ASQoL, median (IQR)	11.9 (4.5)	7.1 (5.3)	0.001
BASDAI, mean ± SD	5.6 (2.3)	4.1 (2.1)	<**0.001**
ASDAS-CRP, mean ± SD	2.57 (0.9)	3.34 (0.9)	**0.001**
BASFI, mean ± SD	4.37 (2.4)	2.77 (2.2)	**0.004**
BASMI, median (IQR)	3.4 (1.5)	2.9 (1.6)	0.241
Kinesiophobia, n (%) n=122	17 (81)	48 (47.5)	**0.005**
Fatigue, n (%)	21 (95.5)	59 (52.7)	**0.001**
HADS Anxiety, n (%)	13 (59.1)	14 (12.5)	<**0.001**

ASDAS-CRP: Ankylosing spondylitis disease activity score with C-reactive protein, ASQoL: Ankylosing spondylitis quality of life questionnaire, BASDAI: Bath ankylosing spondylitis disease activity index, BASFI: Bath ankylosing spondylitis functional index, BASMI: Bath ankylosing spondylitis metrology index, BMI: Body mass index, ESR: Erythrocyte sedimentation rate, HADS: Hospital anxiety and depression scale, Hb: Hemoglobin, HLA: Human leukocyte antigen, IQR: Interquartile range, LEI: Leeds enthesitis index, r-axSpA: Radiographic axial spondyloarthritis, SD: Standard deviation