Alpha Psychiatry

ORIGINAL ARTICLE
Alpha Psychiatry 2023;24(2):68-74
DOI: 10.5152/alphapsychiatry.2023.22908

Evaluation of the Role of Affective Temperamental Features, Automatic Thoughts, and Symptom Interpretation on Disease Activity in Patients with Axial Spondyloarthritis

ABSTRACT

Objective: Axial spondyloarthritis is a systemic and chronic inflammatory disease. Psychological liability to depression and anxiety influences the disease process, prognosis, and treatment outcomes of other medical conditions. Early detection and treatment of these psychiatric conditions would also help in improving the physical functioning of patients with axial spondyloarthritis by reducing the patient's anxiety and depression symptoms. We evaluated the affective temperamental features, automatic thoughts, symptom interpretation, and their relationship with disease activity in patients with axial spondyloarthritis.

Methods: A total of 152 patients diagnosed with axial spondyloarthritis are recruited. Axial spondyloarthritis disease activity was calculated by Bath Ankylosing Spondylitis Disease Activity Index. Depression and anxiety levels were screened with Hospital Anxiety and Depression Scale while affective temperament was evaluated with Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-autoquestionnaire version and automatic thoughts were screened with Symptom Interpretation Questionnaire, and Automatic thoughts questionnaire.

Results: It was observed that 48% (n = 73) were female. The mean age was 43.5 (10.5) years, Bath Ankylosing Spondylitis Disease Activity Index score was 3.97 (1.14). According to the Bath Ankylosing Spondylitis Disease Activity Index scale, 53.30% (n = 81) of the patients were in high disease activity. We found that HAD-depression, HAD-anxiety, Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-autoquestionnaire version, Symptom Interpretation Questionnaire, and Automatic Thoughts Questionnaire scores were significantly higher in the high disease activity group.

Conclusion: Patients' temperament characteristics and mood disorders may affect composite disease activity scores such as Bath Ankylosing Spondylitis Disease Activity Index. In patients with high disease activity scores despite receiving appropriate treatment, mood disorders may need to be evaluated. There is a need to develop disease activity scores unaffected by mood disorders.

Keywords: Affective temperament, automatic thoughts, mood disorder, depression, spondyloarthritis

Introduction

Axial spondyloarthritis (axSpA) is a systemic and chronic inflammatory disease that causes inflammation in the spine and sacroiliac joints and may be associated with enthesitis, peripheral arthritis, and uveitis. Axial spondyloarthritis can lead to functional and structural disorders.[1] It can lead to a decrease in working ability owing to its early onset and progressive deformations.[2] As a result, family and social relationships are negatively affected.[3]

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Received: March 30, 2022
Accepted: January 24, 2023
Publication Date: March 29, 2023

Cite this article as: İzci Duran T, Pamukçu M, Ulusoy H, Altınbaş K. Evaluation of the role of affective temperamental features, automatic thoughts, and symptom interpretation on disease activity in patients with axial spondyloarthritis. *Alpha Psychiatry*. 2023;24(2):68-74.

The prevalence of mood disorders was found to be higher in patients with axSpA compared to the general population, and the most common mood disorders were reported to be depression and anxiety.[4] Depression can be a result of a person's deterioration in health and/or emotional response to an illness.[5] Consistent with this, temperament, as a heritable feature, is strongly related to the regulation of mood, biological rhythm, cognitive functions, and automatic emotional response to psychosocial and environmental factors.[6] The concept of temperament is associated with emotions and cognitive and behavioral patterns experienced in the family starting from the early age of life of a relatively stable individual.[7] Therefore, affective temperamental features are thought to be subclinical presentations of mood disorders such as depression.[8]

Affective temperaments have been described into 5 different dominant profiles as depressive, hyperthymic, cyclothymic, irritable, and anxious. These temperamental features can be subtypes of depression, anxiety, or other mood disorders. Studies conducted in recent years show the relationship between autoimmune and chronic inflammatory diseases and temperament characteristics.[9,10] In addition, Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-autoquestionnaire version (TEMPS-A) scores for anxious, depressive, cyclothymic, and irritable temperaments and their sum are strongly associated with suicide risk.[11] More importantly, people at risk of suicide use the Internet for information and news about self-harm and suicidal behavior. In particular, individuals seeking such information about suicide are more likely to use the Internet.[12] Therefore, early diagnosis is important in today's world where access to the Internet is very easy. Moreover, from a psychological perspective, depression is strongly related to negative automatic thoughts and maladaptive coping strategies to stressful life events according to the cognitive model of depression.[13] Individual differences in the interpretations of psychosocial stressors and negative automatic thoughts that occur simultaneously with the impact of stressors may also cause liability to depression.[14] While automatic thoughts are a component of both abnormal and normal cognitions, the presence of a coherent pattern of automatic negative thoughts leads to a decrease in the person's ability to function and adapt adequately to the environment.[14] This psychological liability to depression and anxiety would also influence the disease process, prognosis, and treatment outcomes of other medical conditions.[7] Therefore, considering their relationship with anxiety and depression, the investigation of affective temperament, negative automatic thoughts, and symptom interpretation in patients with axSpA provides an alternative approach to understand patients better from a biopsychosocial perspective. Furthermore, early detection and treatment of these psychiatric conditions would also help in improving the physical functioning of patients with axSpA by reducing the patient's anxiety and depression symptoms. With this background, we hypothesized that mood disorders, affective temperaments, automatic thoughts, and symptom interpretations may have an impact on clinical outcomes in patients with rheumatic diseases. In this study, it was aimed to evaluate the relationships between these physiological states and disease activity in patients with axSpA.

MAIN POINTS

- *This study investigated the associations between these physiological conditions with disease activity in patients with axial spondyloarthritis.*
- *Temperamental characteristics of patients and mood disorders such as depression may affect composite disease activity scores such as Bath Ankylosing Spondylitis Disease Activity Index.*
- *It may be recommended to evaluate temperament characteristics and mood disorders in patients whose symptoms persist despite appropriate treatment and whose disease activity scores are high.*
- *Measures of disease activity based on more objective findings unaffected by mood disorders should be developed.*

Methods

Study Design

In this cross-sectional study, 152 patients aged 18 years and over who were diagnosed and treated with axSpA according to Assessment of SpondyloArthritis International Society criteria[15] in the rheumatology clinic, without a history of substance and alcohol use, and without a history of psychiatric drug use were included.

Patients < 18 years of age, undergoing psychiatric treatment, diagnosed with a malignancy or chronic systemic disease, with a history of alcohol and substance abuse, inflammatory disease history other than axSpA, mental retardation, and pregnant women were excluded.

Ethical committee approval was received from the Ethics Committee of Ondokuz Mayıs University, Faculty of Medicine (Date: 30.12.2020, No: 2020/689).

Data Collection

We consecutively enrolled axSpA patients admitted to the outpatient rheumatology clinic between September 1 and December 31, 2020. The demographic data and clinical data of all patients were recorded. Clinical data such as the age at diagnosis, the drugs they used before and at the time of admission (anti-tumor necrosis factor, non-steroidal anti-inflammatory drugs (NSAIDs), sulfasalazine (SSZ)), their habits (smoking, alcohol, etc.), and other systemic disease history were collected. Physical examination of all patients was performed in terms of rheumatological and systemic diseases. Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) scores calculated by the rheumatologist were used for AxSpA disease activity. Anxiety, depression, temperament and automatic thought states, and symptom interpretation of the patients were evaluated using individual and anonymous questionnaires.

Measurements

Hospital Anxiety and Depression Scale. It is a Likert-type self-assessment questionnaire consisting of 14 items (7 items (odd numbers) measuring anxiety and the other 7 items (even numbers) measuring depression) developed by Zigmond and Snaith[16] to detect states of anxiety and depression. It is designed specifically for nonpsychiatric hospital departments. It is a useful tool for screening anxiety and depression in patients with chronic diseases treated in clinical and outpatient settings; however, the definitive diagnosis should be based on a complete clinical evaluation. In this questionnaire, there are 4 possible answers for each item, which is scored between 0 and 3 points depending on the severity of the symptoms. The cutoff values for the anxiety and depression subscales of the Turkish version have been set at 10 and 7 points, respectively. The reliability of the Turkish

version of Cronbach's alpha coefficient for the anxiety subscale was 0.85 and for the depression subscale was 0.77.[17] In this study, reliability coefficient was 0.91 for Hospital Anxiety and Depression Scale (HADS).

Temperament Evaluation of Memphis, Pisa, Paris, and San Diego Autoquestionaire. Affective temperamental features of the patients were screened by the Turkish version of the TEMPS-A scale. Developed by Akiskal and colleagues in 1997 to evaluate the dominant affective temperament (28), the scale was translated into Turkish by Vahip and colleagues in 2005, who then tested its validity and reliability. The reliability of the Turkish version was 0.73–0.91, and internal consistency was 0.77–0.85. The reliability of the Turkish version of TEMPS-A subscales was alpha 0.77 for the depressive temperament subscale, alpha 0.85 for the cyclothymic temperament subscale, alpha 0.80 for the hyperthymic temperament subscale, alpha 0.82 for the irritable temperament subscale, and alpha 0.84 for the anxious temperament subscale.[18] The Turkish form of the scale consists of 99 items. The scale is completed in 15-45 minutes. This scale is a self-report tool with 5 subscales. It explores the lifelong characteristics of individuals along the lines of depressive, cyclothymic, hyperthymic, irritable, and anxious temperaments. Individuals answer "yes" or "no" when evaluating their life experiences. The cut-off points for determining the dominant temperament were 13 (18 items) for depression, 18 (19 items) for cyclothymia, 20 (20 items) for hyperthymia, 13 (18 items) for irritability, and 18 (24 items) for anxiety. Moreover, it is possible to have more than 1 dominant affective temperament.[18,19] In this study, reliability coefficient was 0.85 for TEMPS-A.

Symptom Interpretation Questionnaire. It was developed by Robbins and Kirmayer,[20] and a validated Turkish version of Symptom Interpretation Questionnaire (SIQ) was used. The reliability of the Turkish version of SIQ subscales was alpha 0.86 for normalizing subscale, alpha 0.87 for psychologizing subscale, and alpha 0.87 for somatizing subscale.[21] It is the scale that evaluates the attribution used by people when interpreting common somatic symptoms. It is a Likert-type self-assessment questionnaire scored between 1 and 4 and questions 13 somatic symptoms. It has been developed to determine people's attribution styles. According to this theory, people interpret the common physical symptoms they suffer as a result of a psychological condition (SIQ-A: psychologization), a disorder in their body (SIQ-B: somatization), or a condition that can normally be seen (SIQ-C: normalization). In this study, reliability coefficients of 0.92 for SIQ.

Automatic Thoughts Questionnaire. Automatic thoughts questionnaire was developed to determine automatic thoughts accompanying depression. The scale was developed by Hollon and Kendall[22] and adapted to the Turkish population by Şahin and Şahin.[23] It is a 5-point Likert-type scale consisting of 30 items. The lowest score that can be obtained is 30 and the highest score is 150. High scores indicate that the individual's automatic thoughts occur frequently. The reliability study was carried out in Turkey. The reliability of the Turkish version Cronbach alpha coefficient was 0.93, and item/total correlations ranged between 0.36 and 0.69.[24]

Bath Ankylosing Spondylitis Disease Activity Index. Bath Ankylosing Spondylitis Disease Activity Index is a self-completed scoring to measure disease activity. It includes 6 categories, that is, malaise, enthesitis, spine pain, joint swelling, severity of morning stiffness, and duration of morning stiffness. Each of these 6 features is numerically rated between 0 and 10 on an assessment scale. The overall score is calculated by dividing the mean of the scores of fatigue, swelling, spine pain, enthesitis, and morning stiffness and severity by 5. The overall score ranges from 0 to 10, and a higher score reflected a more active disease.[25,26] Bath Ankylosing Spondylitis Disease Activity Index score $\geq$ 4 was defined as high disease activity.[27] The reliability of the Turkish version of BASDAI was 0.80.[28]

Statistical Analysis

The data were analyzed using the IBM Statistical Program for Social Statistics version 22.0 (IBM SPSS Corp.; Armonk, NY, USA). Descriptive statistics of the data are presented with n (%) and, for non-normalized variables (for non-parametric tests) are shown as "median (min-max)," and for normalized variables (for parametric tests) are shown as "mean (SD)." The normality of the variables was tested with the Kolmogorov–Smirnov test. Independent samples *t*-test was used for intergroup comparisons of numerical variables with normal distribution, while Mann–Whitney *U*-test was used for those without normal distribution. Pearson correlation coefficient (normally distributed data) or Spearman correlation coefficient (non-normally distributed data) was used for correlation. Factors affecting anxiety, depression, temperament, automatic thoughts, and symptom interpretation were analyzed using the Backward LR selection method and simple linear regression analysis. A *P*-value $< .05$ was considered statistically significant.

Results

The gender distribution of our study population revealed that 48.00% (n = 73) were female. The mean age was 43.5 (10.5), and the mean age at diagnosis of the study population was 37.8 (9.7). According to the disease activity assessment of the patients, the mean BASDAI score was found to be 3.97 (1.14). Upon evaluation of the patients according to BASDAI scores, 53.30% (n = 81) of the patients had high disease activity (BASDAI score $\geq$ 4) and 46.70% (n = 71) had low disease activity. Human leukocyte antigen (HLA)-B27 was positive in 67.80% (n = 103) of the patients. Treatment regimens of the patients were also evaluated, while 30.30% (n = 46) of the patients were using biological disease-modifying anti-rheumatic drugs, 29.60% (n = 45)

Table 1. Demographic, Clinical, and Laboratory Data

Female, n (%)		73 (48%)
HLA-B27 positivity, n (%)		103 (67.80%)
Age, year, mean (SD)		43.5 (10.5)
Age at diagnosis, year, mean (SD)		37.8 (9.7)
BASDAI, mean (SD)		3.97 (1.14)
Sedimentation (mm/h), median (min-max)		9 (2-73)
CRP (mg/L), median (min-max)		5.5 (0.1-76.5)
Sacroiliitis, n (%)	Bilateral	130 (85.50%)
	Left	15 (9.90%)
	Right	7 (4.60%)
Treatment, n (%)	NSAID	45 (29.60%)
	SSZ + NSAID	61 (40.10%)
	Biologic DMARDs	46 (30.30%)

BASDAI, Bath Ankylosing Spondylitis Disease Activity Index; CRP, C-reactive protein; DMARD, disease-modifying anti-rheumatic drugs; NSAID, non-steroidal anti-inflammatory drug; SSZ, sulfasalazine.

were using NSAIDs, and 40.10% (n = 61) were using NSAIDs plus SSZ treatments. Table 1 shows the patients' demographic, clinical, and laboratory data.

When the cut-off score was 7 for depression, 87 (57.20%) patients had depression, while when the cut-off score was 10 for anxiety, anxiety was found in 47 (30.90%) patients.

When the patients were grouped and compared according to disease severity, the psychiatric scale scores such as HADS-depression, HADS-anxiety, TEMPS-A depressive, TEMPS-A cyclothymic, TEMPS-A hyperthymic, TEMPS-A irritable, TEMPS-A anxious, SIQ-A, SIQ-B, SIQ-C, and Automatic thoughts questionnaire (ATQ) were significantly high in the group with high disease activity (4 (1-16) vs. 10 (3-18), $P < .001$; 4 (2-19) vs. 10 (2-20), $P < .001$; 6 (2-16) vs. 13.5 (2-17), $P < .001$; 4 (1-17) vs. 8 (2-15), $P < .001$; 5 (1-12) vs. 7 (1-15), $P < .001$; 5 (2-12) vs. 7.5 (2-14), $P < .001$; 7 (3-20) vs. 12 (3-19), $P < .001$; 7 (1-51) vs. 17 (3-49), $P < .001$; 7 (1-50) vs. 15 (2-53), $P < .001$; 9 (1-49) vs. 17 (6-54), $P < .001$; 43 (32-105) vs. 77 (32-115), $P < .001$, respectively) (Table 2).

When patients were compared according to gender, no significant difference was found in terms of age, age at diagnosis, BASDAI, HADS-depression, HADS-anxiety, TEMPS-A depressive, TEMPS-A cyclothymic, TEMPS-A hyperthymic, TEMPS-A irritable, TEMPS-A anxious, SIQ-A, SIQ-B, SIQ-C, and ATQ (42 (22-70) vs. 44 (21-64), $P = .176$; 36 (20-61) vs. 40 (18-58), $P = .156$; 4.1 (1.56-6.44) vs. 4.05 (1.14-5.97), $P = .635$; 8 (2-18) vs. 7 (1-17), $P = .630$; 7 (2-20) vs. 7 (2-19), $P = .589$; 9 (3-17) vs. 11 (2-17), $P = .577$; 7 (2-15) vs. 6 (1-17), $P = .833$; 6 (1-14) vs. 6 (1-15), $P = .540$; 6 (2-14) vs. 7 (2-12), $P = .567$; 10 (3-19) vs. 9 (3-20), $P = .820$; 12 (2-49) vs. 13 (1-51), $P = .979$; 11 (2-53) vs. 11 (1-50), $P = .884$; 14 (1-54) vs. 14 (2-49), $P = .833$; and 58 (32-115) vs. 59 (32-114), $P = .435$, respectively). Similarly when the patients were grouped and compared according to HLA-B27 positivity, no significant difference was found in terms of age, age at diagnosis, BASDAI, HADS-depression, HADS-anxiety, TEMPS-A depressive, TEMPS-A cyclothymic, TEMPS-A hyperthymic, TEMPS-A irritable, TEMPS-A anxious, SIQ-A, SIQ-B, and ATQ (44 (24-66) vs. 43 (21-70), $P = .276$; 39,5 (21-56) vs. 38 (18-61), $P = .856$; 4.08 (1.56-5.91) vs. 4.10 (1.14-6.44), $P = .161$; 7 (3-16) vs. 8 (1-18), $P = .806$; 7 (3-19) vs. 7 (2-20), $P = .737$; 8.5 (2-17) vs. 12 (3-17), $P = .182$; 5 (1-17) vs. 6.5 (2-15), $P = .112$; 6 (1-15) vs. 6 (1-14), $P = .941$; 6.5 (2-14) vs. 7 (2-12), $P = .934$; 10 (3-20) vs. 10 (3-19), $P = .793$; 11 (2-51) vs. 13 (1-41), $P = .687$; 10 (1-53) vs. 11 (2-39), $P = .453$; and 53 (32-115) vs. 61. 5 (33-114) $P = .136$, respectively).

A positive correlation was found between disease activity and psychiatric scale scores (HADS-depression (rho = 0.782, $P < .001$), HADS-anxiety (rho = 0.731, $P < .001$), TEMPS-A depressive (rho = 0.708, $P < .001$), TEMPS-A cyclothymic (rho = 0.553, $P < .001$), TEMPS-A hyperthymic (rho = 0.557, $P < .001$), TEMPS-A irritable (rho = 0.459, $P < .001$), TEMPS-A anxious (rho = 0.564, $P < .001$), SIQ-A (rho = 0.672, $P < .001$), SIQ-B (rho = 0.637, $P < .001$), SIQ-C (rho = 0.636, $P < .001$), and ATQ (rho = 0.700, $P < .001$) (Table 3)).

Variables found to be statistically significant ($P < .05$) in univariate analyses were included in linear regression analysis. The linear regression analysis of the patients by BASDAI scores showed that BASDAI scores increased with the increase in HADS-depression ($\beta = 0.132$, $P < .001$), TEMPS-A depressive ($\beta = 0.049$, $P = .038$), SIQ-C ($\beta = 0.054$,

Table 2. Comparison of Patients' Psychiatric Scale Scores by Disease Activity

	BASDAI		
Psychiatric Scale	**<4 46.70% (n = 71) median (min-max)**	**≥4 53.30% (n = 81) median (min-max)**	***P***
HADS-depression	4 (1-16)	10 (3-18)	**<.001**
HADS-anxiety	4 (2-19)	10 (2-20)	**<.001**
TEMPS-A depressive	6 (2-16)	13.5 (2-17)	**<.001**
TEMPS-A cyclothymic	4 (1-17)	8 (2-15)	**<.001**
TEMPS-A hyperthymic	5 (1-12)	7 (1-15)	**<.001**
TEMPS-A irritable	5 (2-12)	7.5 (2-14)	**<.001**
TEMPS-A anxious	7 (3-20)	12 (3-19)	**<.001**
Symptom Interpretation Questionnaire—Yes	3 (1-13)	6 (2-14)	**<.001**
Symptom Interpretation Questionnaire—A	7 (1-51)	17 (3-49)	**<.001**
Symptom Interpretation Questionnaire—B	7 (1-50)	15 (2-53)	**<.001**
Symptom Interpretation Questionnaire—C	9 (1-49)	17 (6-54)	**<.001**
Automatic thoughts questionnaire	43 (32-105)	77 (32-115)	**<.001**

BASDAI, Bath Ankylosing Spondylitis Disease Activity Index; HADS, Hospital Anxiety and Depression Scale; TEMPS-A, Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-Autoquestionnaire version.
P-values are obtained via Mann–Whitney U test.

Table 3. Correlation Between Patients' Mood Disorder Scale Scores and Disease Activity

Psychiatric Scale	**BASDAI**	
HADS-depression	Rho	0.782
	P	**<.001**
HADS-anxiety	Rho	0.731
	P	**<.001**
TEMPS-A depressive	Rho	0.708
	P	**<.001**
TEMPS-A cyclothymic	Rho	0.553
	P	**<.001**
TEMPS-A hyperthymic	Rho	0.557
	P	**<.001**
TEMPS-A irritable	Rho	0.459
	P	**<.001**
TEMPS-A anxious	Rho	0.564
	P	**<.001**
Symptom Interpretation Questionnaire—A	Rho	0.672
	P	**<.001**
Symptom Interpretation Questionnaire—B	Rho	0.637
	P	**<.001**
Symptom Interpretation Questionnaire—C	Rho	0.636
	P	**<.001**
Automatic thoughts questionnaire	Rho	0.700
	P	**<.001**

BASDAI, Bath Ankylosing Spondylitis Disease Activity Index; HADS, Hospital Anxiety and Depression Scale; TEMPS-A, Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-autoquestionnaire version.
P values are obtanied via Pearson or Spearman correlation coefficient.

Table 4. Linear Regression Analysis of Psychiatric Scale by BASDAI

Scale	β	*P*
HAD-depression	0.132	**<.001**
HAD-anxiety	0.032	.306
TEMPS-A depressive	0.049	**.038**
TEMPS-A cyclothymic	−0.019	.494
TEMPS-A hyperthymic	0.014	.643
TEMPS-A irritable	0.038	.237
TEMPS-A anxious	−0.022	.338
Symptom Interpretation Questionnaire—A	−0.035	.096
Symptom Interpretation Questionnaire—B	−0.031	.092
Symptom Interpretation Questionnaire—C	0.054	**.001**
Automatic thoughts questionnaire	0.011	**.022**

$R^2 = 0.655$.
BASDAI, Bath Ankylosing Spondylitis Disease Activity Index; HADS, Hospital Anxiety and Depression Scale; TEMPS-A, Temperament Evaluation of Memphis, Pisa, Paris, and San Diego-autoquestionnaire version.
P values are obtanied via Backward LR selection method and simple linear regression analysis.

P = .001), and ATQ (β = 0.011, *P* = .022) scores (Table 4). The *P*-value of the significance of the regression model is <.001.

Discussion

Axial spondyloarthritis is a chronic inflammatory rheumatic disease that progresses with permanent joint deformities, limitation of movement because of loss of joint function, and loss of ability to work. The chronical nature of axSpA makes psychological factors as important as physical in terms of life functioning and life satisfaction. In line with this, in the present study, BASDAI scores were correlated with all psychiatric scores including HADS, TEMPS-A, SIQ, and ATQ. The HADS-depression, TEMPS-A depressive, SIQ-C, and ATQ scores were associated with high BASDAI scores. Similarly, all psychiatric scale scores were significantly higher in the patients with high disease activity compared to low disease activity. These findings indicate that psychological factors such as depressive temperament, automatic thoughts and depressive symptoms may be associated with disease activity in patients with axSpA assessed with composite scores such as BASDAI.

Patients with ankylosing spondylitis were reported to be vulnerable to developing depression and anxiety compared with the general population.[29,30] There are studies reporting that disease activity and inflammation are associated with depression in patients with axSpA.[5,31] In a meta-analysis of approximately 5000 patients with axSpA, it was reported that depression was common and associated with higher disease activity, and the rate of patients with at least moderate depression was found to be 15%. Additionally, in the same study, it was emphasized that the estimated frequency can vary between 38% and 52% according to the scales used in the diagnosis and the accepted cut-off values.[32] In the present study, we found that anxiety and depression scores were higher in patients with high disease activity compared with low disease activity. Our findings were consistent with the literature but attributing this situation to disease activity alone is insufficient. In fact, these patients have to cope with the thought that they may need to use drugs throughout their lives and may encounter possible physical complications of the disease.

Studies have reported that negative/emotional and evasive coping strategies are used more frequently in patients with axSpA.[33] In the present study, correlations between automatic thoughts and psychologization, somatization, and BASDAI scores suggest that patients may be using these strategies. However, this study also revealed that disease activity was associated with the normalization subscale of ATQ. Normalization relates to how people interpret bodily sensations and what they attribute them to. Patients with high disease activity may be trying to cope by normalizing their existing symptoms. Frequent use of normalization in patients with high disease activity could also be related to the patients' psychological awareness. Patients with axSpA may have low emotional awareness (alexithymia) characteristics. This "emotional failure" is supposed to predispose to certain somatic diseases.[34,35] In the previous studies, a high prevalence of alexithymia is found in patients with inflammatory and immune-mediated diseases, particularly systemic lupus erythematosus,[36,37] ankylosing spondylitis,[38] psoriasis,[39] and rheumatoid arthritis.[40] However, since we did not measure the alexithymia, it is difficult to make further comments on it.

The most important result of our study is the association between the affective temperaments of the patients and BASDAI scores. The concept of affective temperament is related to the emotions, cognitive functions, and behaviors that a person has experienced at home from an early age. Temperament is a structural trait that is inherited and changes little throughout life. By definition, it refers to structural and genetic attitudes and behaviors with a biological basis.[41] Temperamental features are thought to be stable through lifespan attributing that each temperament has underlying genes that are also related to psychiatric clinical syndromes.[42] A previous study reported that in those with high BASDAI values, the anxious, depressive, and cyclothymic temperament scores were higher.[7] Similarly, in this study, we found that temperament characteristics scores were significantly high in the group with high disease activity. This shows that disease activity assessed by composite scores such as BASDAI may be affected by the temperament in patients with axSpA. In our study, regression analysis of BASDAI and temperament characteristics revealed a correlation between depressive temperament and BASDAI. In a study by Yildirim et al.[7] a significant relationship between Beck depression inventory and Beck anxiety inventory scores and anxious, depressive, irritable, and cyclothymic temperaments was reported and it was emphasized that affective temperament may be a risk factor for anxiety and depression in axSpA patients.

Our study has several limitations. First, although our study included axSpA patients who had no psychiatric diagnosis, the absence of a psychiatric evaluation nevertheless remains a limitation. The second limitation is the cross-sectional nature of the study. Third, axSpA patients are recruited from a single center. This situation limits the generalizability of the results of this study, which has a relatively large sample size. Fourth, only self-assessment screening forms were used to identify psychiatric symptoms and the absence of a control group. No other composite scores assessing disease activity other than BASDAI is another limitation of our study. Fifth, the effect of drugs used on BASDAI was not evaluated. Considering that most of the patients have advanced diseases, the heterogeneity of the

sample is another limitation. Additional comparative studies with larger sample sizes are needed to evaluate the effects of temperament and character traits on long-term treatment goals.

In conclusion, depression and anxiety scores as well as all affective temperament scores, symptom interpretation, and automatic thoughts scale scores were found to be high in axSpA patients with high disease activity. This suggests that anxiety and depression may affect disease activity in patients with axSpA. In addition, the high scores on affective temperament, automatic thoughts, and symptom interpretation scales, which are associated with anxiety and susceptibility to depression, may contribute to our understanding of the mechanism of depression and anxiety in axSpA patients. The axSpA patients automatically interpret their bodily sensations negatively may cause symptoms of depression and anxiety, which may increase disease activity. Psychiatric interventions (both pharmacological and psychotherapy) may contribute to reducing disease activity in these patients. However, the cross-sectional design of our study makes it difficult to comment further. We think that it is necessary to evaluate temperament characteristics and mood disorders in patients whose symptoms persist despite appropriate treatment and whose disease activity scores are high. There is a need to develop measures of disease activity based on more objective findings unaffected by mood disorders. We think that the evaluation of temperament characteristics and mood disorders is needed in patients with persistent symptoms and high disease activity scores despite receiving appropriate treatment. There is a need to develop measures of disease activity based on more objective findings unaffected by mood disorders.

Ethics Committee Approval: *Ethical committee approval was received from the Ethics Committee of Ondokuz Mayıs University, Faculty of Medicine (Date: 30.12.2020, No: 2020/689).*

Informed Consent: *Written informed consent was obtained from all participants who participated in this study.*

Peer-review: *Externally peer-reviewed.*

Author Contributions: *Concept – T.İ.D., M.P., H.U., K.A.; Design – T.İ.D., M.P., H.U., K.A.; Supervision – T.İ.D., M.P., H.U., K.A.; Materials – T.İ.D, M.P., K.A.; Data Collection and/or Processing – T.İ.D., M.P., H.U., K.A.; Analysis and/or Interpretation – T.İ.D., M.P., H.U., K.A.; Literature Review – T.İ.D., M.P., H.U., K.A.; Writing – T.İ.D., M.P., H.U., K.A.; Critical Review – H.U., K.A.*

Declaration of Interests: *The authors declare that they have no competing interest.*

Funding: *The authors declare that this study had received no financial support.*

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