

Alexithymia, Anger, Sensitivity to Mild Bodily Sensations and Personality Characteristics of Restless Legs Syndrome Patients: A Case-control Study



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ABSTRACT

Objective: This study aims to assess alexithymia, anger and its expression, sensitivity to bodily sensations, personality, and their relationship with the severity of the disease in patients with Restless Legs Syndrome.

Method: The study included 63 patients diagnosed with Restless Legs Syndrome and 63 age, gender and education matched controls. All participants were given, Toronto Alexithymia Scale, Somatosensory Amplification Scale, The State Trait Anger Scale and Temperament and Character Inventory. The severity of Restless Legs Syndrome was evaluated using the Restless Legs Syndrome Severity Rating Scale.

Results: The trait anger score ($p=0,001$), sensitivity to bodily sensations ($p<0,001$), and the total score of alexithymia ($p<0,001$) were significantly higher in the patient group. Reward dependence in patient group was significantly higher ($p=0,008$). Restless Legs Syndrome severity positively correlated with trait anger level ($r=0,360$; $p=0,015$) and alexithymia total score ($r=0,373$; $p=0,003$). Restless Legs Syndrome severity negatively correlated with self-directedness ($r=-0,323$; $p=0,010$).

Conclusion: We demonstrated that alexithymia, sensitivity to body sensations, and anger was high in restless leg syndrome in Restless Legs Syndrome. Restless Legs Syndrome is linked to physical and mental symptoms and certain personality traits.

Keywords: Anger, Emotions, Personality, Restless Legs Syndrome, Sensations, Temperament

INTRODUCTION

Restless Leg Syndrome (RLS) is a common neurologic disorder characterized by uncomfortable sensations, paresthesia and an urge to move legs (and rarely arms) during sleep or resting (Gossard et al. 2021). According to the epidemiological studies, the prevalence of RLS varies between 5-15% (Trotti 2017, Khacatryan et al. 2022). Although the severity of symptoms in RLS varies from person to person, the ability to fall asleep and maintain sleep is significantly affected (Bollu et al. 2018). It is known that disrupted sleep patterns are a contributing potential factor to the mood and anxiety disorders. It has been proven that RLS is associated with anxiety, depression and some personality traits and negatively affects cognitive functions

and quality of life (Kalaydjian et al. 2009, Rubi 2018, Aydın and Özdemir 2019).

Alexithymia is defined as a decrease in the ability to be aware of one's emotions and defining one's emotions. It also includes externally oriented thinking and reduction in imagination skills (Rosenberg et al. 2020). Impairments in emotional awareness can be seen in patients with psychiatric and neurological diseases and chronic pain (Kumar et al. 2022). Alexithymia, which is used to express mental changes observed in psychosomatic disorders, is thought to be an adaptive regression reaction accompanying psychiatric diseases (Aaron et al. 2019, Hogeveen and Grafman 2021).

The fact that people who consult a doctor with RLS complaints do not describe their current complaints well

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leads to underdiagnosis of the disease. They define their emotions that they cannot express verbally by somatization (Spiegelhalter and Hornyak 2008). Symptoms similar to sleep disturbance, cognitive disorder, tiredness, paresthesia and somatic symptom disorders are frequently seen in RLS cases (Khachatryan et al. 2022). It is known that anger, which is not expressed through denial, is associated with many psychosomatic conditions. It has been shown that in diseases with recurrent and chronic symptoms, individuals have increased sensitivity to bodily sensations and are angry (Toledo et al. 2019, Kumar et al. 2022, Shaygan et al. 2022). Personality traits are an important factor affecting individuals' response to stress for all disorders. Review of the literature shows that high harm avoidance and low self-management are personality profiles associated with mood and susceptibility to chronic diseases (Çakmak et al. 2014, Turkel et al. 2015). RLS has been associated with certain personality traits such as neuroticism, introversion, hysteria, hypochondriasis and psychasthenia, which can increase the risk of developing psychiatric disorders (Kalaydjian et al. 2009).

It is necessary to examine the clinical presentation of RLS, which is common and often accompanied by comorbid psychiatric disorders, symptoms requiring additional intervention in treatment, and various personality traits, and to compare these with findings from previous studies on the general population. In this study, the aim was to determine personality, degree of alexithymia, anger and its expression, sensitivity to bodily sensations and its relations with RLS severity in RLS patients. Determining the psychiatric symptoms and personality traits associated with RLS will contribute to the literature on the disorder and help determine the intervention area in psychotherapeutic approach.

METHOD

Study Design

This study was conducted between 01.05.2023 and 01.08.2023 at the Neurology Outpatient Clinic of the Süleyman Demirel University Research and Practice Hospital with 63 patients diagnosed according to RLS diagnostic criteria and 63 healthy volunteers similar to the patients regarding age, gender, marital status, education, and smoking status-alcohol consumption. The inclusion criteria for the study were over 18 years of age, under 65 years of age, being literate, and agreeing to participate. Those with psychotic disorders/mood disorders with psychotic features, mental retardation, neurological diseases other than RLS and organic mental illnesses that would impair judgment were not included in the study. After the subjects who met the inclusion criteria were informed about the research, those who accepted

to participate in the study signed the Informed Volunteer Consent Form. Each participant underwent a clinical interview, during which structured diagnostic information was collected through face-to-face interviews with a seasoned psychiatrist in the psychiatric department. The research was carried out in accordance with the Declaration of Helsinki and with the approval of the Süleyman Demirel University Clinical Research Ethics Committee (No. 116, April 19, 2022).

Measurement Tools

General and sociodemographic information: The researchers filled out a form of 12 items to patients and healthy volunteers to obtain information about the study's independent variables, such as sociodemographic characteristics and clinical features of the disease duration and medications for RLS. Data was obtained via this form, encompassing several demographic factors such as age, gender, marital status, educational attainment, occupation, smoking and alcohol consumption habits, presence of chronic illness, familial history of RLS, duration of RLS therapy, and drugs used for RLS.

Assessment of RLS: The diagnosis of RLS is mainly based on clinical history. Diagnostic criteria were established by the International Restless Legs Syndrome Study Group (IRLSSG). Patients who meet all criteria are diagnosed with RLS. The IRLSSG diagnostic criteria, revised in 2014, were used by the interviewer to diagnose RLS (Table 1) (Allen et al. 2014).

Evaluation of RLS severity: The disease severity scale (IRLSSG-RS) created by IRLSSG was applied to patients who met RLS diagnostic criteria to evaluate disease severity (IRLSSG 2003). The scale consists of a total of 10 questions rated between 0-4 (0: Not at all, 1: Less severe, 2: Moderately severe, 3: Severe, 4: Very severe). The score obtained in total reflects the severity of the disease. The maximum score is 40, with 1-10 as mild, 11-20 as moderate, 21-30 as severe, and 31-40 as very severe disease. A Turkish validity and reliability study of the scale was conducted, and the Cronbach's alpha internal consistency coefficient was found to be 0.89 (Ay et al. 2019).

Assessment of Alexithymia: The Toronto Alexithymia Scale (TAS), the first validated alexithymia scale, was used in our study. The Likert-type scale consists of 20 questions scored between 1 and 5 (1: Never, 2: Rarely, 3: Sometimes, 4: Frequently, 5: Always). TAS: It consists of three subscales: TAS-1, TAS-2, and TAS-3. The TAS-1 subscale deals with difficulty recognizing and defining emotions; the TAS-2 subscale deals with inadequacy in expressing emotions, and the TAS-3 subscale deals with external-oriented thinking style. High scores indicate a high level of alexithymia (Bagby

Table 1. International Restless Leg Syndrome Study Group RLS Diagnostic Criteria**Basic Diagnostic Criteria**

Often accompanied by uncomfortable and unpleasant sensations in the legs and an irresistible urge to move the legs.
 Symptoms are present or worsen during periods of inactivity and rest
 Symptoms are relieved or ameliorated by activity such as walking and stretching
 Symptoms occur only in the evenings and at night, or are worse than during the day.
 These features cannot be considered in relation to other medical or behavioural conditions (e.g. leg cramps, myalgia, arthritis, venous stasis, positional discomfort, leg oedema, habitual foot shaking).

Supporting Criteria

Family history of RLS in first-degree relatives
 Response to dopaminergic treatment
 Periodic leg movements during wakefulness and sleep

RLS: Restless Leg Syndrome

et al. 1994). A validity and reliability study was conducted in Turkey. The internal consistency examination of the scale and its subscales showed that Cronbach's alpha value was 0.78 for the total scale and varied between 0.57 and 0.80 for the subscales. In addition, confirmatory factor analysis results showed that the scale supported the three-factor structure as in the original, and its internal consistency was sufficient (Güleç et al. 2009).

Assessment Bodily Sensations: The Somatosensory Amplification Scale (SAS) is a 10-item self-rating scale that assesses sensitivity to mild bodily sensations that are unpleasant and bothersome but not pathological. The items consist of unpleasant physical sensations that do not indicate disease. For each item, there are increased scores from 1 to 5, corresponding to the expressions 'not true' and 'completely true.' An amplification score is obtained by summing the scores (Barsky et al. 1988). A study on the scale's Turkish validity and reliability was conducted, and Cronbach's alpha internal consistency coefficient was found to be 0.73 (Güleç and Sayar 2007).

Assessment of Anger: Our study used The State-Trait Anger Expression Inventory (STAXI) to measure anger and expression. It is a four-point Likert-type scale consisting of 34 items. It consists of four dimensions: Trait Anger (TA, ten items), Anger In (AI, eight items), Anger Out (AO, eight items), and Anger Control (AC, eight items). High scores from the TA dimension indicate a high level of anger, high scores from the AI dimension indicate repressed anger, and high scores from the AO dimension suggest that anger can be expressed easily. High scores from the AC dimension indicate that anger is controllable. The scores obtained in each dimension are summed, and the participants' scores are calculated separately for the four dimensions (Spielberger et al. 1983). In the Turkish validity and reliability study of the test, the internal consistency coefficients for the scale were found as follows: 0.79 for the TA dimension, 0.62 for the AI

dimension, 0.78 for the AO dimension, and 0.84 for the AC dimension (Özer 1994).

Assessment of Personality Traits: Temperament and Character Inventory (TCI) is a self-assessment tool consisting of 240 items rated as "true" or "false". TCI consists of seven scales, four temperament scales, and three character scales. Temperament has four dimensions, which are defined as Novelty Seeking (NS), Harm Avoidance (HA), Reward Dependence (RD), and Persistence (P). Character has three dimensions: Self-Directedness (SD), Cooperativeness (C), and Self-Transcendence (ST). Subscales are available for all dimensions except P. In temperament, NS has four subscales, HA has four subscales, and RD has three. In the character dimension, SD is divided into five subscales, C into five subscales, and ST into three subscales (Cloninger et al. 1993). The Turkish validity and reliability study of the scale was conducted, and Cronbach's alpha values were between 0.60 and 0.85 in the temperament dimension and 0.82 and 0.83 in the character dimension. The internal consistency, validity, and reliability of the Turkish TCI were found to be at an adaptable level (Kose et al. 2004, Arkar et al. 2006). The sub-dimensions of the TCI and the expression of the high scores are shown in Table 2.

Statistical Analysis

The data were analyzed using SPSS (Statistical Package for the Social Sciences) 26. Normality assumptions of continuous variables were analyzed using the Kolmogorov-Smirnov test, and homogeneity of variance was examined using Levene's test. It was determined that the data did not fit the normal distribution. Descriptive statistics of continuous variables were expressed as median (min-max), mean, and standard deviation, and categorical variables were defined as frequency (n) and percentage (%). Mann-Whitney-U test was used to analyze numerical data with two-level variables. As the data were not normally distributed, the Kruskal-Wallis H test was used for three-level comparisons. In case of a statistically

Table 2. Temperament and Character Inventory Sub-dimensions and Expression of High Scores

Temperament Dimension	
Novelty Seeking (NS)	
NS1 Exploratory excitability	Tendency for excitement and adventure
NS2 Impulsiveness	Quick decision making
NS3 Extravagance	Wasteful behaviour with money, energy and emotions
NS4 Disorderliness	Quick temper, projecting anger, disliking fixed routines and rules
Harm Avoidance (HA)	
HA1 Anticipatory worry	Tendency to anticipate loss and failure
HA2 Fear of uncertain	Inability to tolerate uncertainty or unusual circumstances that are dangerous
HA3 Shyness with strangers	Timidity, reluctance to enter into relationships
HA4 Fatigability	Low energy, easy fatigue
Reward Dependence (RD)	
RD1 Sentimentality	Easy to show emotions
RD2 Attachment	Building warm and lasting social bonds
RD3 Dependence	Needing emotional support and approval from others
Persistence (P)	Dedication to success against frustration and fatigue
Character Dimension	
Self-Directedness (SD)	
SD1 Responsibility	Accepting responsibility for their attitudes and behaviours
SD2 Purposefulness	Target oriented behaviour
SD3 Resourcefulness	Efficiency, productivity and innovation
SD4 Self-acceptance	Recognising and accepting their strengths and weaknesses, self-confidence
SD5 Congruent second nature	Developing harmonious good habits and self-discipline
Cooperativeness (C)	
C1 Social	Accepting people with different behaviours, views and values
C2 Empathy	To be able to put oneself in the place of others
C3 Helpfulness	Enjoyment in serving others
C4 Compassion	Forgiveness even when evil is done
C5 Principled	To adopt ethical principles in social and interpersonal relationships
Self-Transcendence (ST)	
ST1 Self-forgetfulness	Exceeding your own limits
ST2 Transpersonal identification	Willingness to make personal sacrifices
ST3 Spiritual acceptance	Belief in miracles, extrasensory experiences

significant difference between the groups, the Bonferroni correction was applied. Post-hoc analyses were used in the case of a relationship. Spearman's correlation analysis was used to evaluate the relationships between the scales since a normal distribution was not observed. Logistic regression analysis was employed as a form of multivariate analysis. Significant factors identified in univariate analyses, as well as variables with p-values below 0.25 that were not significant, were incorporated into the logistic model (Levy ve Stolte 2000). In all analyses, $p < 0.05$ was accepted as the significant level.

RESULTS

A total of 126 participants, including 81 women (64.3%) and 45 men (35.7%) with a mean age of 39.95 ± 8.11 y (range, 20–57 y) in the study. No significant differences were found between the groups concerning the sociodemographic data (age, gender, smoking status and alcohol consumption, level of education, and marital status) ($p > 0.05$) (Table 3).

Trait anger ($p = 0.001$), anger-in ($p = 0.001$), anger-out ($p = 0.002$), SAS ($p < 0.001$), TAS1 ($p < 0.001$), TAS2

Table 3. Comparison of Socio-demographic Characteristics of Patients and Controls Included in the Study

	Patients n (%)	Control n (%)	p
Age (mean ± SD) (years)	41.00±8.90	38.90±7.11	0.148
Gender			
Female	40 (63.5%)	41 (65.1%)	0.853
Male	23 (36.5%)	22 (34.9%)	
Marital status			
Married	44 (69.8%)	37 (58.7%)	0.193
Single	19 (30.2%)	26 (41.3%)	
Education status			
Middle school	7 (11.1%)	5 (7.9%)	0.074
High school	21 (33.3%)	11 (17.5%)	
University	35 (55.6%)	47 (74.6%)	
Smoking status			
Yes	36 (57.1%)	42 (66.7%)	0.271
No	27 (42.9%)	21 (33.3%)	
Alcohol consumption			
Yes	11 (17.5%)	11 (17.5%)	1.000
No	52 (82.5%)	52 (82.5%)	
Chronic Disease			
Yes	47(74.6%)	38(60.3%)	<0.001
No	16(25.4%)	25(39.7%)	

($p=0.003$), TAS3 ($p=0.002$), TAS total ($p<0.001$) and TCI RD1 ($p=0.008$) averages were significantly higher in patients than in controls. In addition, the mean scores of TCI S1 ($p=0.039$) and TCI S3 ($p=0.002$) were significantly higher in controls than in patients (Table 4). The TCI RD2 was determined to be 0 for all individuals, making it impossible to compare between groups.

The median age of the patients was 40, and the median duration of RLS was two years. A statistically significant difference was found between RLS severity and age ($p=0.048$). The age of patients with severe RLS symptoms was significantly higher than those with mild to moderate symptoms ($p=0.014$). The family members of 17.5% of those diagnosed with RLS also had a diagnosis of RLS. Mostly mothers ($n=12$) of those with a family history of RLS were diagnosed. In addition to RLS, 74.6% of the patients had additional chronic diseases and the most common comorbidities were anemia and rheumatic diseases. It was found that the presence of chronic disease showed a statistically significant difference between the patient and control groups ($p<0.001$).

13.8% ($n=23$) of the patient group were receiving medication for the diagnosis of RLS, and the majority of them were

using dopamine agonists ($n=19$). The RLS severity score was significantly higher in the treatment group than in the non-treatment group ($p=0.001$). The anger trait score was significantly lower in the control group than in the treatment and non-treatment groups ($p=0.006$; $p=0.004$). In the control group, the SAS score was significantly lower than in both the treatment and non-treatment groups (both $p<0.001$). The total TAS score was significantly lower in the control group compared to both the treatment and non-treatment groups (both $p<0.001$). There was no statistically significant difference between the three groups in the sub-dimensions of TCI NS, TCI HA, TCI RD, TCI P, TCI S, TCI C and TCI ST ($p=0.301$; $p=0.811$; $p=0.983$; $p=0.278$; $p=0.088$; $p=0.385$; $p=0.647$). Table 5 shows the comparison of the mean scale scores of the groups receiving treatment for RLS, those not receiving treatment and the control groups.

A moderately positive correlation was found between RLS severity and trait anger score ($r=0.360$; $p=0.015$) and TAS total score ($r=0.373$; $p=0.003$). Table 6 shows the correlation between RLS severity score and scale scores. A moderately negative significant correlation was found with TCI SD ($r=-0.323$; $p=0.010$) (Table 7).

Table 4. Comparison of Mean Scale Scores Between Patients and Healthy Controls

	Patients (n=63)		Control (n=63)	p
	mean ± SD		mean ± SD	
TA	21.90± 6.31		18.03± 3.98	<0.001
AI	18.24± 4.38		3.98± 3.25	<0.001
AO	16.79± 4.20		15.46± 3.44	0.002
AC	21.67± 4.68		22.57± 3.93	0.208
SAS	30.30± 8.22		24.40± 6.05	<0.001
TAS1	19.19± 7.34		13.85± 4.96	<0.001
TAS2	12.51± 4.13		10.41± 3.63	0.003
TAS3	19.78± 3.40		17.73± 3.72	0.002
TAS Total	51.48± 11.28		42.00± 9.47	<0.001
TCI SD1	4.38± 2.09		5.19± 1.69	0.039
TCI SD2	5.55± 2.05		5.63±1.55	0.818
TCI SD3	2.82± 1.49		3.70±1.54	0.002
TCI SD4	5.25± 2.60		4.90±2.58	0.582
TCI SD5	8.49± 1.96		8.73±2.21	0.406
TCI SD	26.52± 7.87		28.16±6.36	0.302
TCI RD1	7.28± 1.75		6.38±2.00	0.008
TCI RD3	3.25± 1.87		3.87±1.69	0.082
TCI RD4	2.00± 1.16		2.36±1.42	0.132
TCI RD	12.54± 3.35		12.62±3.50	0.885

TA: Trait Anger, AI: Anger In, AO: Anger Out, AC: Anger Control, SAS: Somatosensory Amplification Scale, TAS: Toronto Alexithymia Scale, TAS1: Toronto Alexithymia Scale-1, TAS2: Toronto Alexithymia Scale-2, TAS3: Toronto Alexithymia Scale-3, TCI SD: Temperament and Character Inventory Self-Directedness, TCI SD1: Temperament and Character Inventory Self-Directedness-1, TCI SD2: Temperament and Character Inventory Self-Directedness-2, TCI SD3: Temperament and Character Inventory Self-Directedness-3, TCI SD4: Temperament and Character Inventory Self-Directedness-4, TCI SD5: Temperament and Character Inventory Self-Directedness-5, TCI RD: Temperament and Character Inventory Reward Dependence, TCI RD1: Temperament and Character Inventory Reward Dependence-1, TCI RD2: Temperament and Character Inventory Reward Dependence-2, TCI RD3: Temperament and Character Inventory Reward Dependence-3, TCI RD4: Temperament and Character Inventory Reward Dependence-4, SD: standard deviation.

Table 5. Comparison of Mean Scale Scores of Groups Receiving and Not Receiving Medication for the Diagnosis of RLS and Control Groups

	Patients		Control (n=63)	p
	Not receiving treatment (n=40) median (min-max)	Receiving treatment (n=23) median (min-max)	median (min-max)	
RLS severity score	25 (12-38)	29 (16-38)	-	0.001
TA	20.5 (11-39)	23 (14-36)	19 (10-25)	0.003
SAS	30 (14-44)	32 (12-46)	25 (14-41)	<0.001
TAS Total	47 (28-74)	54 (30-74)	41 (26-64)	<0.001
TCI NS	17 (11-26)	18 (12-25)	19 (6-29)	0.301
TCI HA	18.5 (6-31)	16 (9-30)	19 (1-30)	0.811
TCI RD	13 (7-21)	13 (6-21)	13 (5-22)	0.983
TCI P	6 (2-8)	6 (2-8)	5 (1-8)	0.278
TCI SD	29 (12-39)	23 (12-39)	28 (16-41)	0.088
TCI C	30 (14-38)	30 (22-39)	30 (10-39)	0.647
TCI ST	19 (11-31)	20 (14-30)	19 (3-29)	0.385

RLS: Restless Legs Syndrome. TA: Trait Anger, SAS: Somatosensory Amplification Scale, TAS: Toronto Alexithymia Scale, TCI NS: Temperament and Character Inventory Novelty Seeking, TCI HA: Temperament and Character Inventory Harm Avoidance, TCI RD: Temperament and Character Inventory Reward Dependence, TCI P: Temperament and Character Inventory Persistence, TCI SD: Temperament and Character Inventory Self-Directedness, TCI C: Temperament and Character Inventory Cooperativeness, TCI ST: Temperament and Character Inventory Self-Transcendence.

Table 6. Correlation Between RLS Severity and Scale Scores in the Patient Group

		RLS severity	TA	AI	AO	AC	SAS	TAS Total
RLS severity	r	1						
	p							
TA	r	0.360	1					
	p	0.015						
AI	r	0.125	0.525	1				
	p	0.328	<0.001					
AO	r	0.046	0.621	0.438	1			
	p	0.722	<0.001	<0.001				
AC	r	-0.019	-0.409	-0.040	-0.373	1		
	p	0.881	<0.001	<0.001	<0.001			
SAS	r	0.243	0.351	0.364	0.309	-0.119	1	
	p	0.055	<0.001	<0.001	<0.001	0.186		
TAS Total	r	0.373	0.420	0.532	0.265	0.010	0.517	1
	p	0.003	<0.001	<0.001	0.003	0.911	<0.001	

RLS: Restless Legs Syndrome, TA: Trait Anger, AI: Anger In, AO: Anger Out, AC: Anger Control, SAS: Somatosensory Amplification Scale, TAS: Toronto Alexithymia Scale.

Table 7. Correlation Between RLS Severity and Personality Sub-dimensions in the Patient Group

		RLS severity	TCI NS	TCI HA	TCI RD	TCI P	TCI SD	TCI C	TCI ST
RLS severity		1							
TCI NS	r	0.106	1						
	p	0.409							
TCI HA	r	0.180	-0.037	1					
	p	0.158	0.771						
TCI RD	r	-0.220	0.238	-0.200	1				
	p	0.083	0.060	0.116					
TCI P	r	-0.040	-0.332	-0.358	0.044	1			
	p	0.753	0.008	0.004	0.730				
TCI SD	r	-0.323	-0.275	-0.430	-0.008	0.280	1		
	p	0.010	0.029	<0.001	0.953	0.026			
TCI C	r	-0.055	-0.214	0.035	0.142	0.115	0.203	1	
	p	0.669	0.092	0.778	0.268	0.368	0.111		
TCI ST	r	0.150	0.345	-0.035	0.355	-0.117	-0.451	-0.015	1
	p	0.241	0.006	0.787	0.004	0.360	<0.001	0.906	

RLS: Restless Legs Syndrome, TCI NS: Temperament and Character Inventory Novelty Seeking, TCI HA: Temperament and Character Inventory Harm Avoidance, TCI RD: Temperament and Character Inventory Reward Dependence, TCI P: Temperament and Character Inventory Persistence, TCI SD: Temperament and Character Inventory Self-Directedness, TCI C: Temperament and Character Inventory Cooperativeness, TCI ST: Temperament and Character Inventory Self-Transcendence.

Table 8. Logistic Regression Model Summary

	-2log likelihood Cox&Snell	R ²	Neigelkerke R ²
Step 1	126.002	0.320	0.427

Table 9. The Effect of Age, Trait Anger, Toronto Alexithymia Scale Total, Somatosensory Amplification Scale, Temperament and Character Inventory Self-directedness Variables on the Model in the Logistic Regression Model with Restless Legs Syndrome As the Dependent Variable

				%95CI		
	β	SD	p	Exp (β)	Min	Max
Age	0.096	0.032	0.003	1.101	1.033	1.172
TA	0.168	0.054	0.002	1.183	1.064	1.315
TAS	0.078	0.027	0.004	1.081	1.025	1.140
SAS	0.082	0.035	0.020	1.086	1.013	1.164
TCI SD	0.089	0.040	0.028	1.093	1.010	1.182

CI: Confidence Interval, TA: Trait Anger, TAS: Toronto Alexithymia Scale, SAS: Somatosensory Amplification Scale, TCI SD: Temperament and Character Inventory Self-Directedness, SD: standard deviation.

Logistic regression Enter method was used to analyze the effect of the parameters on the control and patient groups. In the analyses, statistically significant values and values very close to significance were added as covariate variables (age, trait anger, SAS, TAS and TCI SD). In our analysis, the Hosmer-Lemeshow test result of $p=0.666$ shows that our model is compatible. According to the summary of the model, the presence of RLS is explained by the scale scores, which are dependent variables, at a rate between 32% and 42.7% (Table 8). It was observed that age, trait anger, SAS, TAS and TCI SD scores were predictive factors for the presence of RLS ($p<0.05$) (Table 9).

DISCUSSION

Alexithymia, which increases sensitivity to bodily sensations, and high anger levels have been observed in RLS. People express their emotions which they cannot verbalize by somatization. The inability of people who consult a doctor with RLS complaints to describe their current complaints well leads to inadequate diagnosis of the disease and inadequate treatment (Spiegelhalter and Hornyak 2008). The aim of this study was to compare the alexithymia, anger, expression of anger, sensitivity to bodily sensations and personality characteristics of patients diagnosed with RLS with healthy controls and to investigate whether there is a relationship between these characteristics and RLS severity. Results of this study show that there is difference in anger, expression of anger, sensitivity to bodily sensations and degree of alexithymia in patients diagnosed with RLS compared to patients without RLS. It also has been shown that there is a relationship between severity of RLS and sensitivity to bodily sensations and anger level. In our study, patients diagnosed with RLS have been associated with certain personal traits.

Alexithymia is reported to be positively associated with a number of somatic symptoms and psychological factors such as somatosensory amplification. In a study which investigated alexithymic characteristics in migraine patients, it was reported that the migraine group was more alexithymic than the control group (Neyal et al. 2004). In another study which investigated alexithymia, anger level and psychological distress in patients diagnosed with myofascial pain syndrome, it was observed that patients scored significantly higher on the difficulty in recognizing emotions subscale of alexithymia compared to the control group (Castelli et al. 2013). In a study investigating the prevalence of alexithymia in fibromyalgia and chronic migraine patients, it was shown that alexithymia was more common in fibromyalgia patients compared to healthy controls (Ghiggia et al. 2022). A meta-analysis shows that the average prevalence of alexithymia in fibromyalgia is 48%. In fibromyalgia, alexithymia was found to be significantly higher and positively correlated with pain

intensity compared to healthy controls and people with other pain-related conditions, especially rheumatoid arthritis (Asgarabad et al. 2023). Although there are studies examining the relationship between chronic pain and psychosomatic symptoms and alexithymia, there are few studies on the frequency of alexithymia in RLS (Yılmaz et al. 2018, Ellmerer et al. 2020, Heim et al. 2022, Sandri et al. 2023). In a study, RLS patients were more alexithymic than healthy controls while no significant relationship was found between RLS severity and degree of alexithymia. (Yılmaz et al. 2018). In another study, alexithymia was shown to be a factor affecting the need to add tone-ups in RLS (Heim et al. 2022). In our study, it has been observed that the patient group had difficulty in defining and expressing their emotions compared to the control group. It has been shown that patients in need of treatment were more alexithymic. Moreover, it has been found that patients who had difficulty in defining and expressing their emotions have higher severity of RLS. The findings suggest that additional interventions to improve the ability of RLS patients to recognize their emotions and express themselves may contribute to treatment.

The finding of significant alexithymia in Parkinson's patients suggests that alexithymia is a condition resulting from dopaminergic insufficiency/dysfunction. Some studies investigating the link between neurobiological changes in Parkinson's disease and alexithymia suggest that the severity of alexithymia is caused by the imbalance of nigrostriatal and mesocorticolimbic dopamine pathways that occur during the course of the disease (Costa et al. 2010, Costa and Caltagirone 2016). It is hypothesized that dopamine dysregulation in the nigrostriatal pathway is also involved in the pathogenesis of RLS. In another study evaluating emotional processes in RLS patients, it was found that patients were more alexithymic and impulsive than the control group. It stands out that these patients have impaired facial emotion recognition, especially for negative emotions such as anger and sadness (Ellmerer et al. 2020). In results of our study, the median disease duration was 2 years and there were no additional patients with Parkinson's disease. It has been shown that patients treated for RLS have more severe symptoms and they have difficulty in defining and expressing their emotions. It has been found that patients treated for RLS have higher level of anger. These results can be interpreted as dopaminergic dysregulation in the chronic process causing neuroplastic changes, which in turn leads to emotional disturbance and impulsivity. However, more comprehensive studies are needed to reveal the dopaminergic pathogenesis in alexithymia.

Studies have shown that there is a correlation between increasing sensitivity to bodily sensations and presence of chronic pain (Boone ve Kim 2019). A study involving patients with migraine revealed a significant increase in their sensitivity to bodily sensations (Cengiz et al. 2019). A

meta-analysis examining hypochondriasis and somatization showed a correlation between increased sensitivity to bodily sensations and somatization (Creed and Barsky 2004). In a study involving 604 patients treated in a psychosomatic diseases clinic, a strong correlation was found between the total number of physical symptoms and perceived psychosocial stress, alexithymia and sensitivity to bodily sensations (Nakao and Takeuchi 2018). As far as we know, there is currently no study investigating sensitivity to bodily sensations in RLS patients. Our study showed that the patient group tended to perceive more normal somatic sensations as intense, harmful and disturbing than the control group and that this increased sensitivity to bodily sensations predicted the disease. However, no significant relationship was found between RLS severity and sensitivity to bodily sensations. The tendency to feel normal bodily sensations as intense and uncomfortable also did not differ between patients who did and did not receive treatment for RLS.

Current research on the level of anger of RLS is limited. A study conducted in China examined a group of young people and their parents to investigate the impact of RLS on quality of life and daily functioning. Findings have shown that individuals with RLS had decreased quality of life, decreased daily functioning, had higher anger levels and experienced outbursts of anger (Zhang 2014). Anger and its expression is seen as one of the important determinants of the progression of somatization. Chronic pain patients often have a high degree of anger suppression and hostility compared to individuals without health problems. This has been shown to be associated with more distinct pain and impairment (Yılmaz et al. 2016). Studies have shown that suppressing anger can increase sensitivity to pain by reducing endogenous opioids (Bruehl et al. 2009, Burns et al. 2015). Inability to express anger has been found to intensify pain by increasing feelings of anger (Burns et al. 2008). Studies comparing fibromyalgia patients with healthy controls have shown that patients internalize their anger more (Sayar et al. 2004). In a study involving individuals with myofascial pain, mean alexithymia and outward anger scores were found to be significantly higher (Castelli et al. 2013). Our study revealed that patients exhibited higher levels of trait anger than controls. Patients have been reported to display their anger by suppressing or externalizing it. However, no significant difference in anger level was found between patients who were treated for RLS and those who were not.

Studies show a relationship between personality dimensions and psychiatric disorders, migraine and fibromyalgia (Naylor et al. 2017). In the literature, there are limited number of studies on personality traits of RLS patients. Our study reveals that people with RLS exhibit high emotional reactivity and show their emotions easily. Compared to control group, they tended to blame others for what happened to them and it is

understood that they felt inadequate and needed help from others when they faced obstacles. It has been shown that the severity of RLS increases as self-management as a character trait decreases in patients. In the analyses, self-management was found to be one of the predictive factors of the disease. A study examining the potential role of personality traits between RLS and psychiatric disorders suggests that neuroticism contributes to the association between RLS and a history of mood disorders (Kalaydjian et al. 2009). In another study on personality traits in RLS, similar to our study, the TCI was used and it was found that individuals with RLS were more cautious and careful but had lower self-management traits compared to controls without RLS (Çakmak et al. 2014).

RLS is not just a disorder of the nervous system, but a disease that significantly affects cognition, mood and functioning. Epidemiologic studies report a 2 to 4 times higher risk of depressive disorders in patients with RLS compared to healthy controls (Hornyak 2010, Happe et al. 2012). It has been shown that as the severity of RLS increases, depression symptoms worsen and quality of life decreases (Fuhs et al. 2014). In the literature, low Self-Management and high Harm Avoidance scores have been consistently reported in psychiatric patients, especially in those with depressive disorders. Harm Avoidance is considered a marker of emotional vulnerability to depression, whereas Self-Management is a marker of executive functioning that protects the individual from depression. However, clinical RLS symptoms such as pain, uneasiness, insomnia are hypothesized to trigger the depression (Melo et al. 2021). However, it seems difficult to explain the relationship between Harm Avoidance and RLS with the data obtained from the TCI. Harm Avoidance has been shown to be associated with the balance of a complex network of neurotransmitters including dopamine and dysfunction of serotonergic activity, while dopaminergic dysfunction is essential in RLS (Yasuno et al. 2001). In a study aiming to evaluate emotional temperament, depressive symptoms and anxiety in RLS patients, the results showed that high scores on emotional character, depression and anxiety scales indicated psychiatric comorbidities in RLS (Başaran and Taş 2022). In a study aiming to evaluate psychological comorbidities in RLS patients, harm avoidance scores expressing fear and anxiety that may arise in the future in the temperament dimension were found to be high in RLS patients (Marconi et al. 2015). In another meta-analysis, a positive correlation was found between the harm avoidance temperament dimension and RLS (Rezaei et al. 2021). Two studies found a strong association between the novelty seeking temperament dimension and parasomnias or sleep-related respiratory problems (Sforza et al. 2002, Perogamvros et al. 2015). In our study, no significant difference was found between patients and controls for harm avoidance and novelty seeking temperament traits.

In our study, it was found that the presence of chronic diseases differed significantly between the patient and control groups. It was shown that RLS patients reported anemia, chronic kidney disease, rheumatic disease, depression and general comorbidities more frequently than controls (Sevim et al. 2004). In one study, it was reported that the prevalence of RLS was higher in patients with comorbidities compared to those without comorbidities and the most common comorbidities in RLS cases were gastroesophageal reflux, anemia and migraine, respectively (Deveci et al. 2012). In another study on the risk factors associated with RLS, it was reported that comorbidities, most commonly anemia, DM and decreased renal function, were significantly more common in RLS patients (Berger et al. 2004). Various mental symptoms have been reported more in the group of patients with RLS and anemia than in the group without anemia (Bae et al. 2021). In our study, it was observed that anemia was the most common chronic disease in the patient group. The results underline the necessity of screening and treating patients with anemia for RLS in order to improve their quality of life.

It would be more accurate to interpret the results we obtained in our study in the light of the limitations of our research. The fact that the study was cross-sectional and the patients were selected from a single center makes it difficult to generalize the subject. Due to the nature of self-assessment questionnaires and the inclusion of personal information in, individuals may have tended to present themselves in a positive light. In the study, psychiatric diseases other than psychotic disorder and mood disorders with psychotic features were not questioned and mental status was not evaluated. In addition, sleep disorders secondary to RLS were not evaluated in patients. To support the current findings, prospective studies with larger samples may better reveal differences between groups.

In conclusion, it is known that RLS is associated with various psychiatric symptoms such as anxiety, alexithymia and anger. These findings affecting the course of the disease are often overlooked by clinicians. In our study, it has been seen that RLS patients have difficulties in defining and expressing their emotions. In addition, patients showed increased levels of anger and a tendency to perceive normal bodily sensations as more intense and disturbing. Due to the high level of alexithymia in RLS and its association with disease severity, therapeutic interventions to help patients recognize and express emotions would be beneficial in the management of psychiatric symptoms in RLS.

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