Original Research

Predicting Pain Perception Based on Psychological Distress in Patients with Rheumatoid Arthritis: The Mediating Role of Sleep Quality

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Abstract

Background and Objective: Patients with rheumatoid arthritis (RA) often suffer from chronic pain due to the nature of the disease, and in addition to the disease itself, this pain can be aggravated under the influence of psychological factors. The study aimed to predict pain perception based on psychological distress and the mediating role of sleep quality in people with RA.

Materials and Methods: This research was conducted by path analysis, including 202 patients with RA who were selected using the convenience sampling method. The study instruments included McGill Pain Questionnaire (MPQ), Pittsburgh Sleep Quality Index (PSQI), and Depression, Anxiety, and Stress Scale (DASS-21). Descriptive statistics reported frequency, mean, standard deviation (SD), and Pearson correlation. In analytical statistics, path analysis was used. Data were analyzed using SPSS and AMOS software.

Results: Psychological distress (anxiety, stress, and depression) had a direct, statistically significant effect on sleep quality. Sleep quality had a direct effect on pain perception. On the other hand, anxiety, stress, and depression, with the mediating role on sleep quality, had a significant influence on pain perception by 0.11, 0.12, and 0.09, respectively. Descriptive statistics showed that a significant correlation existed among independent, mediation, and criteria variables. The proposed predictive model had a good fit.

Conclusion: Along with medical treatments, we need to pay attention to the role of psychological factors such as psychological distress, depression, and sleep quality in patients with RA.

Keywords: Rheumatoid arthritis; Sleep quality; Pain perception; Psychological stress

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Introduction

Rheumatoid arthritis (RA) is a disabling autoimmune disease causing pain, swelling, and stiffness in the joints, joint damage, and loss of functions. It has a progressive nature, and the severity of its symptoms alternates in the way that they sometimes improve and sometimes worsen (1). The prevalence of RA is approximately 1%, and women are three times more likely to get RA than men (1). In patients with RA, pain is one of the most important symptoms of RA which needs specific attention (1, 2). It often remains even after disease control and medications. Therefore, patients often suffer from pain-related disabilities in many aspects of their lives (3). Reviewing the literature, a

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study indicated that psychological distress in these patients was associated with the level of pain they experienced, and pain levels increased with more severe distress (4, 5). On the other hand, psychological distress is common in these patients (6). A study by Bacconnier et al. has found that 46.9% of the patients are with psychological distress at the baseline phase (7). Specifically, previous research and metanalyses have revealed that the prevalence of depression (8) and anxiety (9) among patients with RA are 38.8% and 13.4%, respectively. Therefore, psychological distress in these patients is a common problem that strongly affects their adaptation to the disease and their perception of the pain (4, 5).

Besides psychological distress, sleep quality is another important factor affecting the health status and pain of patients (10). It has been shown that among the RA population, history of sleep disorders is reported, and they often suffer from sleep disturbances and restriction (11-13). More than half of these patients suffer from poor sleep quality that affects symptoms of their illness. The results of studies have shown that when they experience sleep loss, levels of fatigue and pain increase exaggeratedly (14). In a study by Axen, it was found that the history of sleep disturbances was significantly higher in patients with lower back pain than in pain-free individuals (15). Poor sleep quality is related to psychological distress (15, 16). Psychological distress disrupts the onset process of sleep, causes insomnia, and leads to less sleep duration (fewer than 6) (17).

Despite the role of factors such as sleep quality and psychological distress in the perception and reporting of pain in patients with RA, the main focus is on pharmacological treatments, and the role of other factors is less investigated. Regarding the RA population, the limited amount of research on this relationship calls for clarifying research in this area and it requires substantial attention. Considering the fact that psychological distress is as a critical state in these patients, pain is an important common symptom, and sleep quality is an important factor relating to both pain and psychological distress, we aimed to investigate the relationship between these two variables as well as sleep quality as the mediator variable in patiebts with RA.

Materials and Methods

This study was a descriptive correlational study performed in 2022. The population included people with RA in Tehran City, Iran, and 211 patients were selected using the purposive sampling. Patients were chosen from Shariati, Milad, Imam Khomeini, and Shafa hospitals. The sample size was determined based on the Kline model, in which each parameter in the model requires at least 10-20 samples (18). However, to compensate for the drop in subjects and to make a more accurate generalization, the sample increased to 211 people. The data of 9 patients were excluded from the analysis due to incomplete questionnaires. Then, the analysis was performed on 202 patients. Sampling was done using online and in-person surveys. Therefore, when the patients had access to their smartphones, a link to the questionnaires was sent to them; otherwise, the questionnaires were provided in person when they referred for follow-up assessments in patients who were referred to psychotherapy and had not yet started treatment at the time of the research process. The criteria for inclusion in the study are as follows: literacy, history of RA, no substance abuse, no present psychotherapy, no diagnosis of schizophrenia and bipolar disorder based on history of referring to a psychiatrist, type of diagnosis and medications used, no psychiatric medications, and consent to participate.

Instruments

Baseline characteristics: This form was used to collect data on demographic characteristics including age, education level, employment status, and duration of RA.

Pittsburgh Sleep Quality Index (PSQI): This questionnaire is a standardized self-assessment tool designed by Buysse et al. to test sleep quality over the past month. This measurement provides a score ranging from zero to twenty one. Its Cronbach's alpha was 0.89. The results showed that a score of 5 had a diagnostic sensitivity of 89.6% and a specificity of 86.5% (19). In Iran, Farrahi et al. investigated the reliability of the questionnaire using the test-retest reliability method (R = 0.88). A score of 5 or higher indicates poor sleep quality (20).

McGill Pain Questionnaire (MPQ): This questionnaire was developed by Melzack and consists of 15 items rated on a 4-point Likert scale. Using Cronbach's alpha method, its convergent validity and reliability were found to be 0.67 and 0.82, respectively (21). Besides, Wilkie et al. reported a Cronbach's alpha coefficient of 0.84 and a convergent validity of 0.43 (22).

The Depression, Anxiety, and Stress Scale (DASS-21): The scale has 21 questions rated on a Likert scale. Factor analysis results showed that 68% of the total variance of the scale was explained by the 3 factors; Cronbach's alpha was 0.97 for stress, 0.92 for depression, and 0.95 for anxiety (23). The validity and reliability of the scale were studied among Iranian people and the results showed that the reliability for the depression, anxiety, and stress subscales was, respectively, 0.80, 0.76, and 0.77, and Cronbach's alpha for depression, anxiety, and stress subscales were 0.81, 0.74, and 0.78, respectively (24).

Data analysis: In the descriptive section, mean, standard deviation (SD), and Pearson correlation coefficient were reported. In inferential statistics, the path analysis method was used to test direct and indirect effects and relationships between variables. The fit indices to investigate the fit of the model included comparative fit index (CFI), goodness of fit index (GFI), adjusted GFI (AGFI), incremental fit index (IFI), and root mean square error of approximation (RMSEA). Acceptable levels for CFI, GFI, AGFI, and IFI are < 0.90, < 0.95, < 0.90, and < 0.90, respectively. Moreover, the acceptable range for RMSEA is lower than 0.1. Data were analyzed using SPSS (version 25, IBM Corporation, Armonk, NY, USA) and AMOS software. Before presenting the results of the path analysis, its assumptions were approved. The multicollinearity of the variables was investigated using the variance inflation factor (VIF) and tolerance statistics. Normality of data was investigated by kurtosis and skewness. All data were collected anonymously and there was no relationship between the questionnaires and the participants. All participants' personal information was kept confidential, and they filled out an informed consent form before completing the questionnaires.

Results

The sample included 211 patients; however, 9 were excluded due to incomplete questionnaires. According to the results of the analysis, 202 patients were included in the study. The mean (SD) age of participants was 51.03 ± 4.30 years old. Regarding the time after the first diagnosis, there were 37 patients (18.31%) under one year, 53 (26.23%) from one to three years, 65 patients (21.32%) from three to six years, 31 (15.34%) from six to nine years, and 16 (7.92%) for above nine years. Other characteristics are presented in table 1.

Table 1. Characteristics of the participants

Variable		n (%)
Marital status	Married	175 (86.63)
	Single	27 (13.37)
Education	Diploma and below	90 (44.55)
	Bachelor's degree	63 (31.18)
	Master's degree	35 (17.34)
	Doctorate	14 (6.93)
Age (year)	20-30	15 (7.44)
	30-40	33 (16.33)
	40-50	51 (25.24)
	50-60	103 (50.99)
Gender	Women	81 (40.09)
	Men	121 (59.91)
History of RA	Under one year	37 (18.31)
	One to three years	53 (26.23)
	Three to six years	65 (21.23)
	Six to nine years	31 (15.34)
	Above nine years	16 (7.92)

RA: Rheumatoid arthritis

As shown in table 2, there were significant correlations among the study variables. Moreover, the results showed that there was no multicollinearity among the variables. The findings of VIF for the independent variable (sleep quality, stress, depression, anxiety) were 1.40, 1.83, 1.52, and 1.93, respectively. Additionally, the normality of data was checked using skewness and kurtosis. Because skewness and kurtosis for all variables were between +2 and -2, as a result, the assumption of normality was confirmed.

The model fit indices had to be modified. The fit indices of the primary model for CFI, GFI, AGFI, IFI, and RMSEA were 0.53, 0.79, 0.48, 0.54, and 0.30, respectively.

Table 2. Correlation matrix of the study variables

Variable	1	2	3	4	5	VIF	Skewness	Kurtosis	Mean ± SD
Sleep quality	1					1.40	-0.68	-1.11	6.48 ± 1.75
Pain perception	0.42*	1					0.17	0.31	21.00 ± 4.55
Stress	0.49*	0.37*	1			1.83	0.01	0.04	16.06 ± 3.03
Depression	0.44*	0.36*	0.45*	1		1.52	0.68	-0.84	11.77 ± 0.06
Anxiety	0.47*	0.29*	0.41*	0.42*	1	1.93	0.29	-0.12	13.01 ± 3.07

*P < 0.01

VIF: Variance inflation factor; SD: Standard deviation

Table 3. Fit indices of the primary and final model

Fit index	DF	AGFI	IFI	RMSEA	GFI	CFI
Acceptable level	+	> 0.90	> 0.90	< 0.10	> 0.90	> 0.90
Primary model	6	0.48	0.54	0.30	0.79	0.53
Final model	9	0.90	0.95	0.09	0.97	0.95

DF: Degree of freedom; AGFI: Adjusted goodness of fit index; IFI: Incremental fit index; RMSEA: Root mean square error of approximation; GFI: Goodness of fit index; CFI: Comparative fit index

After applying the modification indices, the results of the fit indices indicated that the model was acceptable. The fit indices of the final model for CFI, GFI, AGFI, IFI, and RMSEA were 0.95, 0.97, 0.90, 0.95, and 0.09, respectively. Therefore, the model in figure 1 demonstrates a good fit. Figure 1 shows the path analysis results, and table 3 shows the fit indices of the final model.

In addition, the standardized regression coefficients of depression, anxiety, and stress on sleep quality were 0.20, 0.26, and 0.28, respectively, which were statistically significant. Besides, the effect of sleep quality on pain perception was 0.43. The results are reported in table 4.

On the other hand, the total indirect and direct effects were 0.18 and 0.31, respectively, and both of them were significant ($P < 0.01$). An indirect effect of stress on pain perception was analyzed with the mediating role of sleep quality and was 0.12, which was statistically significant. Furthermore, the results of the standard indirect coefficients of depression and anxiety on pain perception with the mediating role of sleep quality are reported in table 5.

Discussion

The present study was conducted to predict pain perception based on psychological distress and the mediating role of sleep quality in patients with RA. There was a significant correlation between sleep quality and pain perception, such that poor sleep quality would lead to increased pain perception. This finding is consistent with previous studies, which have shown that there is a relationship between poor sleep quality and higher pain perception (25, 26). The presence of sleep problems is associated with focusing on symptoms, physical sensitivity, and low pain threshold. For this reason, patients become sensitive to the symptoms of the disease and instead of naturally experiencing their pain, they perceive it as a disaster (27). RA is a chronic disease that lasts a lifetime and often causes limitations and unpleasant symptoms. Insomnia and sleep problems are associated with rumination and pessimism (28) about these conditions, which leads to not accepting and dealing with the disease and its main symptoms, such as pain, and experiencing more intense symptoms. Additionally, regarding biological evidence, insufficient sleep is associated with reduced levels of pseudomorphine and dopamine, which play an important role in reducing pain perception (29). As a result, when patients have sleep problems, they experience higher levels of pain. Furthermore, the results suggest that psychological distress can predict sleep quality in patients with RA.

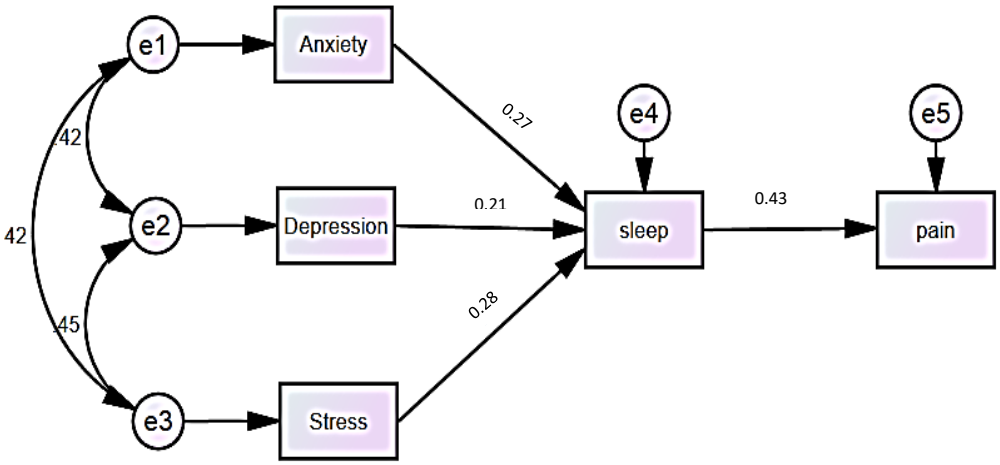

Figure 1. Output model of the mediating role of sleep quality in the relationship between psychological distress and pain perception

Table 4. Results of direct relationships

Path direction	Unstandardized regression coefficient	Standardized regression coefficient	P-value
Depression → sleep	0.28	0.20	0.001
Anxiety → sleep	0.34	0.26	0.001
Stress → sleep	0.39	0.28	0.001
Sleep → pain perception	0.81	0.43	0.001

Table 5. Results of indirect relationships

Path direction	Unstandardized beta	Standardized beta	P-value
Stress → sleep → pain perception	0.18	0.12	0.01
Anxiety → sleep → pain perception	0.17	0.11	0.01
Depression → sleep → pain perception	0.10	0.09	0.01
Stress → sleep → pain perception	0.18	0.12	0.01

This result is consistent with research that has shown there is a significant relationship between psychological distress and sleep quality (30, 31). Some of the patients with RA cannot cope with the disease effectively; then, these patients try to avoid and deny the disease. For this reason, they experience higher levels of different psychological conditions, including anxiety, stress, and depression (32, 33). On the other hand, psychological distress and its related stressors disrupt the sleep process and lead to poor sleep quality. Furthermore, psychological distress plays an important role in the persistence of sleep problems, such that the presence of distress constitutes an important obstacle to the improvement of the disorder. Generally, people who experience more psychological distress have more sleep problems (34). For this reason, many researchers address psychological distress before treating sleep problems. Additionally, from a neurophysiological point of view, levels of serotonin, which plays an important role in improving sleep (35), are reduced in people with psychological distress.

Finally, other research has shown that there is a significant correlation between psychological distress and pain perception with the mediating role of sleep quality. Indeed, psychological distress causes long-term sleep problems, especially insomnia, which leads to an increase in a person's sensitivity to pain, which on the other hand, leads to rumination and pessimism about the condition; therefore, the person feels more pain (27). Furthermore, patients with chronic diseases who do not easily accept their disease cognitively, experience more psychological distress. As a result, they deny the consequences of and limitations due to their disease, and this leads to sleep problems and increased pain perception.

The current study has limitations that future researchers should consider in their studies. The patients in this study included patients with RA; thus, our findings cannot be generalized to other patients with chronic diseases. The present study was cross-sectional. Therefore, it is best for future research to conduct a longitudinal study on other patients.

Conclusion

Sleep quality, stress, anxiety, and depression have an important role in the formation of pain perception of RA.

Conflict of Interests

Authors have no conflict of interests.

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