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Original Article

# Predicting Pain Perception Based on Psychological Distress and Resiliency

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**Abstract**

**Background and aims:** Migraine headaches are frequently accompanied by psychological distress, which can substantially influence pain perception. This study aimed to investigate the relationship between psychological distress and pain perception in individuals with migraines, with a focus on the mediating role of resiliency.

**Methods:** This descriptive-correlational study was conducted in Tehran in 2025 on 207 adults aged 30–60 who were diagnosed with migraines and selected through convenience sampling. Participants completed the McGill Pain Questionnaire, Kessler Psychological Distress Scale, Connor–Davidson Resiliency Scale, and Ahwaz Migraine Headache Questionnaire . Ultimately, descriptive statistics and Spearman correlations were performed in SPSS 27, and path analysis was conducted using SmartPLS 4.

**Results:** The findings revealed several significant relationships. Acceptance was found to negatively impact the quality of life (QoL) through self-care (β=-0.098, $P$=0.011). In contrast, positive reframing, mediated by self-care, had a positive influence on QoL (β=0.115, $P$=0.001). However, rumination negatively affected QoL (β=-0.191, $P$=0.001), and blaming others also negatively affected QoL through self-care (β=-0.110, $P$=0.004). Nonetheless, other components demonstrated no significant indirect effects ($P$>0.05).

**Conclusion:** The findings indicated that psychological distress is a key factor influencing pain perception in individuals with migraines. Meanwhile, resiliency plays a meaningful mediating role in this association. Accordingly, considering psychological factors in migraine management can improve pain outcomes and enhance QoL.

**Keywords:** Migraine, Psychological distress, Pain perception, Resiliency

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## Introduction

Migraine is a chronic neurological disorder that is characterized by recurrent, disabling headaches accompanied by nausea, photophobia, phonophobia, and visual disturbances (1). Affecting 12–15% of the global population (2) and 8–20% in Iran (3), migraine substantially impairs the quality of life and daily functioning (4). Psychological distress, including anxiety and depression, plays a significant role in intensifying both the frequency and severity of migraine attacks (5). Moreover, research shows that adolescents and adult women with chronic migraine experience elevated disease uncertainty, contributing to greater emotional burden and impaired adjustment outcomes (6).

Pain perception in migraine involves altered neurological processing that is shaped by chemical changes, inflammation, and heightened sensory responses (7). Psychological and environmental factors further influence pain levels through serotonergic and cerebrovascular mechanisms (8). It is noteworthy that stress, anxiety, depression, irritability, family conflict, and adverse events act as common triggers (9, 10). Furthermore, studies identify childhood migraine, gender, and adult psychological distress as predictors of migraine in adulthood (11), while higher anxiety and depression increase migraine-related disability (12). Positive coping and resiliency are associated with better well-being among migraine patients (13). Nonetheless, disturbances in neural and hormonal systems can intensify vascular and muscular mechanisms underlying pain (14). Thus, increasing resiliency has been shown to reduce stress, depression, anxiety, and fatigue in chronic illness (15, 16), suggesting that resiliency may mediate the relationship between psychological distress and pain perception (17).

Given the substantial adverse effects of pain perception on patients' psychological well-being and family functioning (18-20), identifying variables that explain differences in pain perception is essential. Some studies highlight the significance of resiliency as a critical mediating factor in chronic disease contexts (18, 19, 21), indicating that individuals with higher resiliency may be more capable of buffering the detrimental influence of psychological distress on migraine symptoms. Therefore, understanding the relational dynamics among psychological distress, resiliency, and pain perception is vital for developing effective clinical strategies. Building

on the existing evidence (17-21), the present study seeks to investigate whether resiliency mediates the association between psychological distress and pain perception in individuals suffering from migraine headaches. This approach may lead to more targeted, psychologically informed interventions for migraine management.

## Materials and Methods

The present study employed a descriptive-correlational structural equation modeling design. In addition, the statistical population of this research consisted of adults aged 30–60 years in Tehran in 2025 who experienced migraine headaches, selected via convenience sampling. To determine the sample size for examining a structural model involving 2–4 factors, researchers should aim to collect at least 100–200 cases (22). Using smaller samples can lead to insufficient convergence and inappropriate outcomes, or low accuracy in parameter estimates, especially for standard errors (23). Given this information and the likelihood that some questionnaires would be incomplete, a total of 250 questionnaires were designated for this study.

The inclusion criteria for this study included a clinical diagnosis of migraine in participants as defined by the International Classification of Headache Disorders (ICHD) and an age of 30 years and older. Other inclusion criteria were experiences of psychological distress, including symptoms of anxiety and/or depression, informed consent to participate in the study, and willingness to complete all assessments and follow-up procedures. To ensure accurate identification of migraine cases, the presence of migraine was verified through a standardized two-step diagnostic procedure in accordance with the International Classification of Headache Disorders (3rd edition). First, participants were required to report a prior clinical diagnosis of migraine established by a board-certified neurologist or headache specialist. Then, all participants completed the ID-Migraine screening tool, which is a validated three-item instrument with high sensitivity and specificity for detecting migraine in both clinical and research settings. It should be noted that only individuals who met both conditions were considered eligible for inclusion in the study. This approach ensured that migraine status was reliably confirmed and aligned with internationally accepted diagnostic standards.

Only individuals who fell within the range of early to middle adulthood and enjoyed stable psychological and physical health were enrolled in this study. Additionally, participants were eligible for inclusion in the investigation if they had no history of severe or active psychiatric disorders and possessed sufficient cognitive capacity to fully comprehend the questionnaires, make informed decisions, and provide written informed consent. Similarly, they were required to demonstrate the ability to complete self-report instruments reliably and have adequate language proficiency to understand the questionnaires and instructions.

Moreover, inclusion was contingent upon the individual being in an emotionally and therapeutically stable condition at the time of data collection; in other words, individuals were included in the study if they had not participated in any active psychological intervention within the past 3 months and were not using any psychiatric medications that could affect emotional regulation or pain processing. To ensure that pain perception could be examined without confounding variables, individuals were admitted only if they did not suffer from any physical illnesses that could affect pain perception or if their reported pain was not attributable to complex chronic conditions or specific medical disorders (e.g., neuropathic pain or inflammatory or rheumatologic diseases).

Additionally, participants were excluded if they had experienced any recent trauma or acute stress that could immediately affect their resilience or level of psychological distress. Finally, only individuals who could commit to full collaboration with the researcher and maintain consistent participation throughout all stages of assessment were included, as achieving the study's aims required complete, valid, and unbiased data.

### *Procedure*

The study followed a systematic and structured approach to ensure the integrity and validity of the research process. Initially, recruitment took place through clinics, hospitals, and online platforms targeting individuals diagnosed with migraines using the Migraine Headache Questionnaire. Then, interested participants were screened according to the previously outlined inclusion and exclusion criteria.

Once potential participants were identified, they were invited to an initial assessment session, during which they provided informed consent. During this session, participants also completed a series of questionnaires designed to evaluate their migraine history, psychological distress (anxiety and depression), and resiliency levels. The estimated time for completing the questionnaires was approximately 30–45 minutes. In addition, these assessments were conducted using validated instruments to ensure reliability and accuracy. Ethical considerations were strictly adhered to throughout the research process. Furthermore, participants' confidentiality was maintained, and they were informed about their right to withdraw from the study at any time without penalty. Additionally, the study received approval from an institutional review board to ensure ethical compliance.

A total of 250 participants were selected for the study; however, during the research process, 43 individuals were excluded due to incomplete responses or other limitations. Consequently, only 207 questionnaires were included in the analysis.

After data collection, statistical analyses were performed to examine the mediating role of resiliency in the relationship between psychological distress and pain perception. Then, the results were interpreted in the context of the existing literature, and implications for

clinical practice were discussed accordingly.

### Instruments

#### McGill Pain Questionnaire (MPQ)

MPQ is one of the most prominent tools for measuring the sensory and emotional aspects of pain (24). It consists of 20 descriptive items, each rated on a 6-point intensity scale ranging from 1 (none) to 6 (severe). In this scale, descriptors 1–10 and 11–15 represent the sensory dimension of pain and the emotional dimension, respectively. Further, descriptors 16 and 17–20 demonstrate the evaluative dimension of pain and various types of pain, respectively. This scale was validated in Iran, and the content validity index (CVI = 0.80) and content validity ratio (CVR = 0.88) confirmed its content validity (25). The MPQ's reliability was also assessed, with a Cronbach's alpha coefficient of 0.88.

#### Kessler Psychological Distress Scale (K10)

This scale was developed to identify psychological disorders in the general population (26). It contains 10 items that evaluate psychological distress as a unidimensional construct. The scale uses a 5-point Likert-type scale ranging from never (score of 0) to always (score of 4). The maximum and minimum scores for this test are 40 and 0, respectively. Authors reported a CVI of 0.75 and a reliability coefficient of 0.75 using Cronbach's alpha (26). A study reported that the total average CVR and CVI were 0.88 and 0.95 for the Persian version of the scale (27). In this study, the scale's reliability was 0.93.

#### Connor-Davidson Resiliency Scale

This resiliency questionnaire encompasses 25 items scored on a Likert-type scale from 0 (not true at all) to 5 (true nearly all the time) (28). It includes five subscales: personal competence, trust in one's instincts, tolerance of negative affect, positive acceptance of change, secure relationships, and spiritual influences. Higher scores indicate greater resiliency. In a study, the scale's validity was confirmed with a CVI of 0.87 and a CVR of 0.76 (29). In the present study, the Cronbach's alpha coefficient for the scale was 0.79.

#### Ahwaz Migraine Headache Questionnaire

The AMQ was designed to assess migraine headaches in Ahwaz (30). The questionnaire consists of 25 questions and uses a Likert-type scale to evaluate migraines, with questions such as "Do you fear having a headache in the future when you are not currently experiencing one?" To calculate the questionnaire's total score, all item scores should be summed, and the score range for this questionnaire is 25–100. A higher score represents a greater severity of migraine headaches, and vice versa. Validity concerns how well a measurement tool assesses what it intends to measure (30). In addition, the reliability of a tool refers to its consistency in measuring what it measures, indicating how consistently it yields the same results under similar conditions. The CVI (0.97) and CVR (0.96) confirmed the content validity of AMQ (30). The Cronbach's alpha coefficient for this questionnaire was estimated to be above 0.70.

### Data Analysis

SPSS software (version 27) was utilized to perform descriptive statistics and Spearman correlation, and SmartPLS (version 4) was used to analyze the paths between variables. Further, the Shapiro-Wilk test was employed to estimate the normality of the research variables; considering that the test was significant, the variables were not normally distributed, and SmartPLS and the partial least squares method were used accordingly. The significance level was set at 0.05. The researcher also applied the bootstrap method to examine the role of the mediator variable in the model.

## Results

Regarding gender, 112 of 207 people (54.1%) were female, and the remaining 95 cases (45.9%) were male. Furthermore, individuals were divided into age groups of 30–40 (n = 130), 40–50 (n = 59), and 50–60 (n = 18) years old. The largest number of participants was in the 30–40-year-old group (62.8%). Similarly, most participants were female (54.1%). In terms of education, people were divided into four main categories, including diploma, associate diploma, bachelor's degree, and master's degree. In total, the most prominent participants were in the bachelor's group (35.3%).

Based on the results (Table 1), the mean pain perception score was 65.8 ± 11.2, indicating moderate pain among participants. Psychological distress had a mean of 17.2 ± 6.8, reflecting a range of emotional challenges. Moreover, resiliency scores averaged 50.8 ± 5.8, suggesting generally high levels of coping ability within the group.

Pain perception was positively and significantly correlated with the psychological distress variable (r = 0.598, $P < 0.001$, Table 2), demonstrating that the level of pain perception increases with increasing psychological distress. However, pain perception showed a negative,

**Table 1.** Description of the Main Research Variables

| Variable | Mean ± SD | Minimum | Maximum | Skewness | Kurtosis | Shapiro-Wilk | *P* Value |
|---|---|---|---|---|---|---|---|
| Pain perception | 65.8 ± 11.2 | 43 | 89 | -0.133 | -0.713 | 0.979 | 0.004 |
| Psychological distress | 17.2 ± 6.8 | 10 | 29 | 0.754 | -1.103 | 0.792 | < 0.001 |
| Resiliency | 50.8 ± 5.8 | 40 | 60 | -0.603 | -1.019 | 0.878 | < 0.001 |

*Note*. SD: Standard deviation.

significant correlation with the resilience variable (r = -0.683, $P < 0.001$), representing that pain perception decreases with increased resilience.

Based on the results of Table 3 and Figure 1, psychological distress displayed a positive and significant association with pain perception (β = 0.419, $P < 0.001$), indicating that higher psychological distress was related to higher levels of pain perception. Similarly, psychological distress demonstrated a negative and significant association with resilience (β = −0.551, $P < 0.001$), suggesting that greater psychological distress was attributed to lower resiliency. Furthermore, resiliency had a negative and significant association with pain perception (β = −0.466, $P < 0.001$), implying that higher resiliency was associated with lower pain perception. Moreover, indirect associations were examined (Table 3), and the findings revealed that psychological distress was positively and significantly related to pain perception indirectly through resiliency (β = 0.257, $P < 0.001$). These results confirm that, when resiliency is considered, the association between psychological distress and pain perception decreases from β = 0.419 to β = 0.257.

The obtained data (Table 4) demonstrated that Cronbach's alpha for all constructs exceeded 0.7, indicating high reliability. Additionally, average variance extracted values were above 0.5, confirming model validity. In addition, model fit was assessed, and all indices were satisfactory; specifically, the root mean square error of approximation and normed fix index were 0.044 (below the 0.08 threshold) and 0.948, respectively. Furthermore,

**Table 2.** Spearman's Correlations

| Variable | | 1 | 2 | 3 |
|---|---|---|---|---|
| 1. Pain perception | Spearman's Rho | — | | |
| | *P*-value | — | | |
| 2. Psychological distress | Spearman's Rho | 0.598 | — | |
| | *P*-value | <0.001 | — | |
| 3. Resiliency | Spearman's Rho | -0.683 | -0.529 | — |
| | *P*-value | <0.001 | <0.001 | — |

**Table 3.** Indirect, Direct, and Total Effects

| Path Coefficient | | Estimate | Standard Deviation | t-Value | *P* Value | 95% Confidence Interval | |
|---|---|---|---|---|---|---|---|
| | | | | | | 2.5% | 97.5% |
| Direct effects | Psychological distress -> Pain perception | 0.419 | 0.047 | 8.831 | <0.001 | 0.327 | 0.513 |
| | Psychological distress -> Resilience | -0.551 | 0.055 | 9.943 | <0.001 | -0.657 | -0.439 |
| | Resilience -> Pain perception | -0.466 | 0.049 | 9.510 | <0.001 | -0.557 | -0.366 |
| Indirect effects | Psychological distress -> Resilience -> Pain perception | 0.257 | 0.033 | 7.893 | <0.001 | 0.195 | 0.323 |
| Total effects | Psychological distress -> Pain perception | 0.676 | 0.040 | 16.976 | <0.001 | 0.596 | 0.751 |
| Relationship of components to structures | Emotional perception of pain <- Pain perception | 0.886 | 0.012 | 75.191 | <0.001 | 0.861 | 0.908 |
| | Evaluative perception of pain <- Pain perception | 0.880 | 0.013 | 65.641 | <0.001 | 0.851 | 0.904 |
| | Sensory perception of pain <- Pain perception | 0.922 | 0.008 | 112.279 | <0.001 | 0.905 | 0.938 |
| | Various types of pain <- pain perception | 0.858 | 0.019 | 44.214 | <0.001 | 0.816 | 0.892 |
| | Spiritual Influences <- Resiliency | 0.918 | 0.015 | 61.135 | <0.001 | 0.886 | 0.945 |
| | Trusting Instincts and Tolerating Negative Emotions <- Resiliency | 0.947 | 0.011 | 84.602 | <0.001 | 0.923 | 0.967 |
| | Personal Competence <- Resiliency | 0.975 | 0.005 | 202.019 | <0.001 | 0.964 | 0.983 |
| | Positive Acceptance of Change <- Resiliency | 0.925 | 0.017 | 53.185 | <0.001 | 0.888 | 0.955 |
| | Secure Relationships <- resiliency | 0.932 | 0.016 | 57.120 | <0.001 | 0.896 | 0.960 |

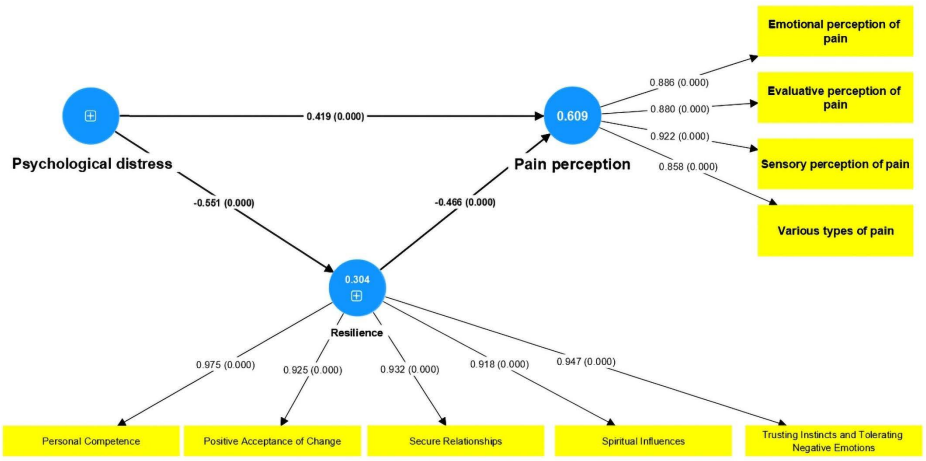


**Figure 1.** Statistical Model With *P* Values and Standard Coefficients

**Table 4.** Reliability and Validity of the Model and Model Fit Statistics

| Variables | Cronbach's Alpha | Composite Reliability | AVE |
|---|---|---|---|
| Pain perception | 0.712 | 0.751 | 0.51 |
| Psychological distress | 0.774 | 0.806 | 0.55 |
| Resiliency | 0.714 | 0.721 | 0.54 |
| **Assessment of model fit statistics** | | | |
| **SRMR** | | **Saturated model** | **Estimated model** |
| NFI | | 0.044 | 0.044 |
| | | 0.948 | 0.948 |
| **Predictive communication $Q^2$** | | | |
| **Variable** | | **$Q^2$ (=1-SSE/SSO)** | |
| Pain perception | | 0.473 | |
| Resiliency | | 0.300 | |
| **Coefficient of determination of the model** | | | |
| **R-squared** | | | |
| **Variables** | | **R-square** | **R-square adjusted** |
| Pain perception | | 0.609 | 0.605 |
| Resiliency | | 0.304 | 0.300 |
| **F-squared** | | | |
| **Variables** | **Pain perception** | **Psychological distress** | **Resiliency** |
| **Pain perception** | | | |
| Psychological distress | 0.313 | | 0.436 |
| Resiliency | 0.387 | | |

*Note*. AVE: Average variance extracted values; SRMR: Root mean square error of approximation; NFI: Normed fix index; SSE/SSO: The sum of squared errors/the sum of squares.

blindfolding confirmed predictive relevance, with $Q^2$ values above zero. Moreover, the R-squared value for pain perception was 0.609, implying that the model explained 60.9% of the variance. Overall, the model demonstrated sufficient fit and predictive power.

## Discussion

The present study examined the pain perception model based on psychological distress, with resiliency playing a mediating role in individuals suffering from migraine headaches. The findings indicated that psychological distress had a significant positive direct effect on pain perception, while it also had a substantial adverse direct impact on resiliency. Likewise, psychological distress exerted a significant positive indirect effect on pain perception through resiliency. Our results are consistent with the findings of studies conducted by DeLone et al (6), Furnham and Cheng (11), Hans et al (12), Kurtses Gürsoy and Köseoğlu Toksoy (13), and Basharpoor et al (18). These studies suggest that greater uncertainty about illness and disease interference is associated with higher symptoms of anxiety and depression. It can be concluded that migraine patients may experience greater perceptions of ambiguity and unpredictability, which contribute to their psychological adjustment outcomes (6).

Childhood migraines and adult psychological distress were identified as independent and significant predictors of migraine prevalence in adulthood, highlighting that early experiences can influence pain perception later in life (11). Hans et al found that higher resiliency scores were associated with a lower likelihood of severe disability from headaches, underscoring that resiliency acts as a protective factor against pain perception (12). Similarly, Kurtses Gürsoy and Köseoğlu Toksoy (13) demonstrated a significant positive correlation between psychological resiliency and positive coping styles, indicating that migraine patients with higher resiliency enjoy a better quality of life and experience less pain perception. Based on the presented research backgrounds, psychological, social, and individual factors influence pain perception in migraine patients. Accordingly, increasing resiliency, reducing psychological distress, and improving coping styles can contribute to decreased pain perception and enhanced quality of life for patients. Therefore, designing therapeutic interventions that consider these factors could improve treatment outcomes for migraine sufferers.

Additionally, Pistoia et al (9), Ma et al (31), and Rostami et al (19) concluded that chronic migraine patients have poorer sleep quality and experience more anxiety. Although these findings help us understand that sleep quality and anxiety can directly affect pain perception, they cannot solely be considered as primary factors in increasing pain perception (9). High scores of psychological distress in individuals with migraines were significantly higher than in the control group. These findings reveal that although psychological distress can

have a direct impact on pain perception, it may have lesser effects compared to other factors, such as resiliency and coping styles (31). The findings of this study confirmed that anxiety, depression, and stress directly affect pain perception and can influence it through enhancing the mediating role of resiliency. While the findings point to the role of resiliency, they indicate that these variables alone cannot explain all dimensions of pain perception (19). Inconsistent studies emphasize that a complete understanding of pain perception requires attention to the interplay of these factors with others, such as sleep quality and individual characteristics (9).

The results can be justified through scientific explanations. For example, resiliency was identified as a protective factor against headache-related disability. The results indicated that higher resiliency scores were associated with reduced headache-related disability, emphasizing that enhancing resiliency can help reduce pain perception (12). Moreover, one study indicated that early experiences can have long-term effects on pain perception in adulthood, suggesting a connection between early experiences and pain perception in adulthood (11).

Additionally, anxiety, stress, and depression, both directly and through resiliency, affect pain perception. These findings demonstrate that while resiliency may have a mediating role, these variables alone cannot account for all dimensions of pain perception and are somewhat inconsistent with other results emphasizing resiliency (19). Under certain conditions, social and economic factors can have distinct impacts on pain perception, which may contradict the results emphasizing individual factors (31).

## Study Limitations and Future Implications

The present study had several limitations. Firstly, the sample size of 207 participants, while adequate for preliminary analyses, may limit the generalizability of the findings. Considering that this sample size was drawn from a specific geographic area (Tehran), it lacks cultural and socioeconomic diversity. Moreover, the cross-sectional design limited causal inferences; although associations between psychological distress, resilience, and pain perception were identified, definitive cause-and-effect relationships could not be established. Additionally, reliance on self-reported measures may introduce bias, and the lack of longitudinal data limits insights into the dynamics of these relationships over time. Finally, the focus on psychological factors may also overlook other relevant variables (e.g., physical health and lifestyle factors).

## Conclusion

The study on the pain perception model based on psychological distress revealed the significant impact of psychological distress on pain perception in individuals suffering from migraine headaches. Notably, resiliency emerged as a critical mediating factor, confirming its essential role in alleviating the adverse effects of psychological distress on pain experiences. This finding indicates the importance of fostering resiliency in patients, as it not only enhances their ability to cope with psychological challenges but also diminishes the intensity of pain they experience. Therefore, interventions aimed at increasing resiliency could be vital in managing migraine-related pain and improving overall patient outcomes.

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### Authors' Contribution

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### Competing Interests

The authors declare that they have no conflict of interests concerning the study and the preparation of this article.

### Ethical Approval

The study received approval from the Ethics Committee of the Islamic Azad University, Najafabad Branch (ethical code IR.IAU.NAJAFABAD.REC.1403.181).

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