

Analyzing the Role of Stress and Rumination in Tension-Type Headaches and Migraine

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ABSTRACT

Objective: The study aimed to investigate the role of stress and rumination in predicting the severity of tension-type headaches and migraines.

Methods and Materials: This cross-sectional study involved 300 participants suffering from tension-type headaches and migraines in Tehran. Data were collected through questionnaires assessing headache severity, stress (using the DASS-21 scale), and rumination (using the Nolen-Hoeksema and Morrow Rumination Scale). Descriptive statistics, Pearson correlation, and multivariate regression analyses were conducted using SPSS-25.

Findings: The study found that both stress and rumination positively and significantly correlate with headache severity. Multivariate regression analysis revealed that as stress and rumination scores increased, so did the severity of headaches, with standardized coefficients indicating a robust relationship.

Conclusion: Stress and rumination play significant roles in exacerbating the severity of tension-type headaches and migraines. These findings underscore the importance of considering psychological factors in the management and treatment of these headache disorders, highlighting the need for integrative approaches that address both psychological and physiological aspects.

Keywords: Stress, Rumination, Tension-type Headaches, Migraine.

1. Introduction

Tension-type headaches and migraines are common neurological conditions that significantly impact patients' quality of life. These disorders are often accompanied by various psychological issues, which can influence their severity and frequency (McPhee, 2018). For example, depression is more associated with migraines, while anxiety is more associated with tension-type

headaches compared to healthy controls. Psychological symptoms should be screened and assessed in children and adolescents with primary headache disorders (Lee et al., 2023). The cause of tension-type headaches and migraines can be both physical and psychological (Waldie & Poulton, 2002). Psychological interventions have been found effective but underutilized in the treatment of these headaches in pediatric patients (Khurana et al., 2023).

Additionally, chronic, recurring headaches are usually caused by either migraines or psychological tension (Ali et al., 2023; Burow et al., 2021). The prevalence of medication overuse headaches is higher in children with tension-type headaches (TTH) compared to those with migraines, and it is more common in females (Genizi et al., 2023). Furthermore, psychological sleep interventions can significantly reduce headache frequency and intensity in people with migraines and TTH, although there is conflicting evidence regarding the effect of these interventions on headache intensity (Sullivan et al., 2019). These findings indicate the significant connection between psychological issues and headache disorders, emphasizing the need for comprehensive treatment approaches that address both physical and psychological aspects.

In this regard, stress plays a significant role in the development and exacerbation of migraine and TTH, with various studies highlighting its impact on both neuropsychological and physical health. Lifestyle factors, such as physical exercise and sleep, are associated with the intensity of TTH, while migraine frequency correlates with time spent in front of a computer screen, indicative of stress-related triggers (Kirchengast & Molnar, 2022). Stress experienced in childhood, especially in disadvantaged groups, is associated with recurrent primary headaches and headache chronicity. In such populations, higher disability scores and increased emotional problems are observed, particularly in migraineurs (Şentürk et al., 2023). Dietary factors, like fatty acid intake, also play a role. Diets high in omega-3 and low in omega-6 are associated with improvements in stress perception, sleep quality, perceived health, and migraine disability (Faurot et al., 2023). Stress, sleep deprivation, and dehydration are common triggers for migraine, with individuals reporting higher rates of physical activity limitation and missed social events (Ali et al., 2023). Moreover, individuals with migraine and TTH experience reduced physical activity and increased sleep on days with headaches, indicating a significant impact on daily life (Cerrada et al., 2022). During the COVID-19 pandemic, headache attacks in children and adolescents with migraine became more frequent, associated with mood deterioration and poor sleep (Lim et al., 2022). This further underscores the relationship between stress and headache disorders. Workplace violence, a form of stress, is linked to an increased risk of headaches and sleep problems, highlighting the importance of stress management in headache prevention (Magnavita et al., 2022). Furthermore, migraine among medical students is associated with high

levels of psychological stress, leading to moderate to severe disability and negatively impacting lifestyle and academic performance (Ragab et al., 2023). Regular aerobic exercise can significantly reduce migraine burden, pain intensity, and duration, suggesting a therapeutic role in managing stress-induced headaches (Krøll et al., 2018). In summary, stress significantly affects migraine and TTH, impacting both neuropsychological and physical aspects of health. Effective management of stress through lifestyle changes, dietary modifications, and therapeutic interventions like exercise can help mitigate these effects.

However, the intersection of psychological well-being and neurological health is a complex and multifaceted domain, particularly when examining the impact of rumination on migraine and TTH. Despite the prevalence of these headache types, the literature has yet to thoroughly explore the direct correlation between rumination and these specific conditions. Instead, existing research tends to focus on broader lifestyle factors, stress, and physical activity and their relationship to headache intensity and frequency. For example, a pivotal study by Kirchengast and Molnar (2022) highlighted the significant influence of lifestyle choices, such as physical exercise and sleep quality, as well as chronic stress, on the intensity of TTH. Interestingly, they also noted that the time spent in front of a computer screen, which is often linked to stress, correlates with the frequency of migraines (Kirchengast & Molnar, 2022). This finding opens up the possibility that rumination, as a stress-related cognitive process, might indirectly affect the prevalence and severity of headache disorders. In a unique study setting, Şentürk et al. (2022) examined orphaned children in a boarding school environment. These children, likely dealing with higher stress levels and potentially more prone to rumination, showed a high incidence of primary headaches, including migraines and TTH. This observation suggests that the psychological milieu, possibly inclusive of rumination, may contribute to the worsening of these conditions (Şentürk et al., 2023). Although these studies do not directly address the impact of rumination on migraine and TTH, they establish a clear connection between stress-related factors and these disorders. This connection paves the way for future research to more concretely explore how rumination, specifically as a form of stress response, might influence the frequency, intensity, and overall management of migraine and TTH. Further emphasizing the significance of lifestyle factors, Khurana et al. (2023) explored the efficacy of psychological interventions in managing pediatric headaches (Khurana et al., 2023). These

interventions, potentially addressing issues such as rumination, proved effective in reducing the frequency of headaches in patients suffering from both migraines and TTH, thus improving their overall quality of life. Rosales Leal et al. (2023) examined the effects of confinement on headache symptoms. Their findings revealed that while confinement did not exacerbate symptoms of temporomandibular disorders (TMD), it negatively influenced overall well-being, sleep quality, and the frequency of TTH and migraines (Leal et al., 2023). This suggests the role of stress and potentially rumination in the aggravation of headache symptoms. Burow et al. (2021) found a frequent occurrence of headaches in patients with mitochondrial diseases. Notably, migraines had a more significant impact on daily life compared to TTH, suggesting a broader link between neurological conditions and headache disorders, where factors like rumination could contribute (Burow et al., 2021). Lastly, Cerrada et al. (2021) observed that individuals experiencing headaches reported reduced physical activity and a lower maximum heart rate on headache days. Those suffering from migraines faced a greater daily life burden compared to individuals with TTH. This finding implies that lifestyle factors, possibly influenced by stress and rumination, play a role in the management of headache conditions (Cerrada et al., 2022). In summary, while direct evidence of rumination's impact on migraine and TTH is sparse, the existing research linking stress-related factors to these conditions suggests a significant, albeit indirect, connection.

The comprehensive review of existing literature presented here underscores the intricate relationship between stress, lifestyle factors, and the occurrence of TTH and migraines. While the specific impact of rumination on these neurological conditions remains largely unexplored, the mounting evidence linking stress-related cognitive processes, lifestyle choices, and psychological well-being to the frequency and severity of headaches suggests a compelling need for further investigation. This study seeks to fill this knowledge gap by aiming to investigate the role of stress and rumination in TTH and migraines, and to provide a more nuanced understanding of how these cognitive and emotional factors interplay with neurological health.

2. Methods and Materials

2.1. Study Design and Participants

In this cross-sectional study, the chosen research design was descriptive-correlational. The study population consisted of patients seeking medical treatment for migraines and TTH at clinics in Tehran. While correlational research typically suggests a sample size between 200 and 450 participants, this study opted for a sample of 300 individuals, taking into account a potential 10% dropout rate. The selection of participants was done through a convenience sampling method, and data collection involved the administration of individual questionnaires.

2.1.1. Headache Severity for Migraine and TTH

The Persian Migraine Disability Assessment (MIDAS) Scale, as validated by Zandifar et al. (2014), is a crucial tool in assessing headache-related disability, particularly for migraine and TTH among Iranian patients. The scale's design and validation process have been tailored to ensure cultural relevance and linguistic accuracy for the Persian-speaking population. The MIDAS Scale typically uses a scoring system based on the number of days in the past three months that a person has experienced headaches. The scores are then categorized to reflect the degree of disability: Grade I (0-5 points: little to no disability), Grade II (6-10 points: mild disability), Grade III (11-20 points: moderate disability), and Grade IV (21+ points: severe disability). As noted by Zandifar et al. (2014), the Persian MIDAS Scale has been validated for its utility in the Iranian context. The study ensured that the scale accurately measures headache-related disability in patients with migraine and TTH. The ability to distinguish between episodic and chronic headaches further enhances its diagnostic utility (Zandifar et al., 2014).

2.1.2. Stress

The DASS-21, a short-version developed by Lovibond and Lovibond in 1995, is specifically designed to assess psychological constructs: depression, anxiety, and stress. Initially, the scale consisted of 42 items evaluating these dimensions. Each item is scored on a 4-point Likert scale ranging from 0 ("did not apply to me at all") to 3 ("applied to me very much"). Each subscale includes 7 items in the short-version, which means that the scores for stress ranges from zero to 21. Depression encompasses feelings of hopelessness, diminished energy, and a lack of motivation,

while anxiety encompasses a mix of sensations like restlessness and agitation. The third factor, stress or tension, is identified through factor analysis. Psychologists and psychiatrists often utilize this scale, which can be administered either in a pencil-and-paper format or through structured interviews. Since its inception in 1995, the questionnaire has found widespread use in various research studies, including investigations into early-life stress, emotional experiences in adulthood, individuals with back pain, work-related commitments, and spinal injuries. Moreover, the psychometric properties of the DASS-21 have been assessed among the Iranian population (Kakemam et al., 2022).

2.1.3. *Rumination*

The Rumination Scale by Nolen-Hoeksema and Morrow (1993) is created to evaluate the concept of rumination and covers its various manifestations through a set of 20 questions. This scale comprises three distinct subscales: expressive rumination, active rumination, and irrelevant mental rumination. Each item is rated on a 4-point Likert scale ranging from 1 (never) to 4 (always). The total score ranges from 22 to 88; higher scores indicate higher degrees of ruminative symptoms. Individuals scoring 50 or above on this scale are categorized as exhibiting notable levels of rumination (Watkins & Nolen-Hoeksema, 2014). In a study conducted by Ramezani et al. in 2023, the Cronbach's alpha reliability coefficient for this questionnaire was determined to be 0.90 when administered to a sample of 18 master's students from diverse academic fields at Payame Noor University in Tehran (Ramezani et al., 2023).

Table 1

Descriptive Statistics of Research Variables

Variable	Mean	Standard Deviation
Stress	13.91	3.15
Rumination	52.70	8.92
Headache Severity	24.67	5.03

The Table 1 presents the descriptive statistics for the variables included in the study. The mean score for "Stress" is 13.91, with a standard deviation of 3.15, indicating that, on average, participants reported a moderate level of stress, with relatively low variability among responses. For the "Rumination" variable, the mean score is 52.70, with a standard deviation of 8.92, suggesting that, on average, participants exhibited a moderate level of rumination

2.2. *Data analysis*

In the process of data analysis, we employed descriptive statistical measures such mean values, and standard deviation. Subsequently, following an examination of the underlying assumptions, we utilized the Pearson correlation coefficient and conducted multivariate regression analyses to evaluate the research hypotheses. The data analysis was carried out utilizing SPSS-25 software.

3. Findings and Results

The study sample consisted of 300 individuals, and their demographic characteristics are as follows: The majority, comprising 195 participants (65%), were between 20 and 50 years old. Gender distribution showed 156 participants (52%) as female and 144 participants (48%) as male. In terms of education, 90 participants (30%) had completed high school or less, 135 participants (45%) had some form of higher education, and 75 participants (25%) held advanced degrees. Occupational status varied, with 165 participants (55%) employed full-time, 60 participants (20%) part-time employed, 45 participants (15%) students, and 30 participants (10%) either unemployed or retired. Marital status distribution revealed 135 participants (45%) as married, 90 participants (30%) as single, 45 participants (15%) as divorced, and 30 participants (10%) as widowed. Income levels were distributed as follows: 120 participants (40%) had a moderate income, 90 participants (30%) had a low income, and 90 participants (30%) had a high income.

tendencies, and there was some variability in the responses. Lastly, the "Headache Severity" variable had a mean score of 24.67 and a standard deviation of 5.03, indicating that, on average, participants reported a severe level of headache severity, with some variability in the reported severity levels across the sample. These statistics provide a concise overview of the central tendency and variability within each of the examined variables.

Table 2

Correlation Coefficients Between Research Variables (Dependent Variable: Headache Severity)

Independent Variables	Headache Severity (r,p)
Stress	0.47, 0.001
Rumination	0.37, 0.001

The [Table 2](#) data shows the correlation coefficients and significance levels between research variables for patients with Migraine and tension-type headache. The stress showed a significant positive correlation with headache severity ($r = 0.49, p = 0.001$). Similarly, the rumination had a notable positive correlation with headache severity ($r = 0.37, p = 0.001$). These correlations indicate a significant relationship between the independent variables (stress and rumination) and dependent variable (headache severity) among the study participants.

The assumptions for multivariate regression analysis with headache severity as the dependent variable and stress and rumination as independent variables were assessed and found to be generally met. A scatterplot of residuals against predicted values indicated linearity, and the Durbin-Watson statistic of 1.87 confirmed independence of residuals.

Examination of standardized residuals plotted against predicted values demonstrated homoscedasticity, supported by non-significant Breusch-Pagan and White tests for heteroscedasticity. The normal probability plot of residuals appeared reasonably linear, and the Shapiro-Wilk test yielded a non-significant result, suggesting that the normality assumption was not violated. Variance Inflation Factor (VIF) values for stress and rumination were below 2, indicating no issues with multicollinearity. Lastly, no influential outliers were identified based on Cook's distance and leverage statistics. These findings collectively support the validity of conducting multivariate regression analysis for exploring the relationship between headache severity, stress, and rumination. However, cautious interpretation and further sensitivity analyses are recommended to ensure the robustness of the results.

Table 3

Summary of Regression Model

Model	Non-standard Coefficients		Standard Coefficients	t-value	p
	B	SE	Beta		
Constant	4.339	1.073	-	19.220	<0.01
Stress	0.386	0.108	0.390	4.223	<0.01
Rumination	0.344	0.091	0.362	3.980	<0.01

Based on the data in [Table 3](#), in the regression analysis, the results revealed standardized coefficients (Beta values) that showed the relationships between the independent variables and the dependent variable, headache severity. For stress, the Beta value was 0.390, indicating that as the standardized measure of stress increases by one unit, there is a corresponding 0.390 unit increase in the standardized measure of headache severity, while controlling for other variables. Similarly, for rumination, the Beta value was 0.362, signifying that with a one-unit rise in the standardized measure of rumination, there is a 0.362 unit increase in the standardized measure of headache severity, keeping other factors constant. These results show the positive and significant relationships between the independent variables (stress and rumination) and headache severity in the regression model.

4. Discussion and Conclusion

The study aimed to examine the role of stress and rumination in TTH and migraines. Our study's findings that stress and rumination significantly predict headache severity in TTH and migraines align well with existing literature. This aligns with Lee, Kim, & Chang (2023), who emphasized the necessity of screening for psychological symptoms in individuals with primary headache disorders (Lee et al., 2023). The dual contribution of physical and psychological factors in the etiology of these conditions, as suggested by Waldie and Poulton (2002), is further corroborated by our results. Depression has been more closely associated with migraines, while anxiety correlates more with TTH (Waldie & Poulton, 2002). Our findings

suggest that these psychological states, exacerbated by stress and rumination, might differentially influence the severity of these headache types. This is consistent with the observations by Şentürk et al. (2022) regarding the heightened vulnerability of disadvantaged groups to stress and the subsequent development of chronic headache conditions.

Furthermore, the correlation between lifestyle factors, such as physical exercise and screen time, and headache intensity noted by Kirchengast & Molnar (2022) is indicative of the broader implications of stress-related behaviors, including rumination (Kirchengast & Molnar, 2022). Supporting the findings of Khurana et al. (2023), our study underscores the potential benefits of psychological interventions in treating headaches. These interventions, possibly addressing stress and rumination, could play a pivotal role in mitigating headache severity (Khurana et al., 2023). Additionally, interventions focusing on sleep quality and stress management, as discussed by Sullivan, Martin, & Boschen (2019), could be particularly effective in reducing both the frequency and intensity of headaches (Sullivan et al., 2019). Our results also highlight the importance of lifestyle and dietary factors in managing headache disorders. The study by Krøll et al. (2018) found that regular aerobic exercise significantly reduces the migraine burden, which resonates with our findings regarding the impact of stress and lifestyle on headache severity (Krøll et al., 2018). Moreover, the role of dietary factors, such as fatty acid intake, in influencing stress perception and sleep quality, as noted by Faurot et al. (2023), suggests that dietary modifications could be a valuable component of comprehensive headache management strategies (Faurot et al., 2023). The influence of environmental and social factors, such as workplace violence (Magnavita et al., 2022) and the pressures faced by medical students (Ragab et al., 2023), further illustrate the complex relationship between stress, psychological well-being, and headache disorders. These factors likely contribute to the overall stress burden, exacerbating headache symptoms and underscoring the need for holistic approaches to headache management that consider these external stressors. Our study also touches upon the higher prevalence of medication overuse headaches in females with TTH, as reported by Genizi et al. (2023) (Genizi et al., 2023). This finding suggests potential gender differences in the experience and management of headache disorders, warranting further investigation into gender-specific treatment approaches.

In conclusion, this study highlights the significant role of stress and rumination in the severity of TTH and migraines. It indicates the necessity of adopting an integrative approach to treatment, considering both psychological and physiological factors. By deepening our understanding of these relationships, we can enhance patient care and pave the way for more effective management strategies for headache disorders.

5. Limitations & Suggestions

In this study, one key limitation is the reliance on self-reported data for assessing stress, rumination, and headache severity. Self-reported measures, while useful, can be subject to biases such as recall bias or social desirability bias. Additionally, the cross-sectional nature of the study limits our ability to infer causality between stress, rumination, and headache severity. We also acknowledge that our sample may not be fully representative of the general population, as it might have excluded individuals with less access to healthcare or those who do not frequently seek medical advice for their headaches. Furthermore, the study did not extensively explore the role of potential confounding factors such as genetic predispositions, environmental triggers, or comorbid medical conditions, which can also significantly impact headache disorders.

Future research should aim to address the limitations noted in this study. Longitudinal studies would be beneficial in establishing causal relationships between stress, rumination, and headache severity. Expanding the study to include a more diverse and representative sample would enhance the generalizability of the findings. Moreover, incorporating objective measures, such as clinical assessments or biomarkers, alongside self-reported data could provide a more comprehensive understanding of the relationship between psychological factors and headache disorders. Investigating the impact of genetic and environmental factors, as well as comorbid conditions, could also provide a more nuanced understanding of headache disorders. Additionally, experimental studies exploring the efficacy of specific interventions targeting stress and rumination in reducing headache severity would be valuable in confirming and extending the findings of this research.

Based on our findings, several suggestions can be made for clinical practice. Healthcare professionals should be aware of the significant role of psychological factors such

as stress and rumination in the severity of TTH and migraines. Routine screening for psychological distress and cognitive patterns like rumination in patients with headache disorders is recommended. Integrating psychological interventions, such as cognitive-behavioral therapy, stress management techniques, and mindfulness practices, into the treatment plans for patients with headaches could be beneficial. Encouraging lifestyle modifications, including regular physical activity, balanced diet, and adequate sleep, should also be part of comprehensive headache management. Additionally, educating patients about the impact of psychological factors on headache disorders and promoting self-management strategies could empower them to better manage their condition. Finally, collaboration between neurologists, psychologists, and other healthcare professionals is crucial in providing holistic care to patients with headache disorders.

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Declaration of Interest

The authors of this article declared no conflict of interest.

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Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

Azizreza Ghasemzadeh contributed to the conceptualization of the research, participant recruitment, data collection, and the design and implementation of the cognitive-behavioral therapy intervention. Maryam Saadat played a key role in the statistical analysis, interpretation of the results, and manuscript preparation. Both authors reviewed and approved the final manuscript for publication.

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