Original Article

Investigating the activity of brain-behavioral systems and resilience through the mediating role of metacognitive beliefs in patients with tension headaches

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Abstract

Introduction: This study aimed to investigate the relationship between the activity of behavioral brain systems and resilience with emphasis on the mediating role of metacognitive beliefs.

Materials and Methods: The population of this correlational study consist the patients with tension-type headaches who referred to neurology clinics and clinical psychologists in Mashhad city during 2018-2019. Amongst them 300 cases were selected by convenient sampling method. Participants were assessed through research assessment tools including Jackson's Five-Factor Questionnaire, Metacognition Questionnaire (MCQ-30) and Connor and Davidson Resilience Questionnaire. The data analyzed by the descriptive statistics, Pearson correlation method, path analysis, AMOS and SPSS version 22.

Results: The findings showed that behavioral brain systems with all three subscales of behavioral inhibition, behavioral activation and FFFS have a direct effect on resilience. (P<0.05), and the two components of the Behavioral Activation System (BAS) and Behavioral Inhibition (BIS) have no direct effect on metacognitive beliefs as a mediating variable, only the FFFS component has a direct negative effect on metacognitive beliefs (P<0.05).

Conclusion: According to the results of the present study, there is a positive and significant relationship between behavioral inhibition system and tension headache. Also, brain -behavioral system and resilience through mediating role of cognitive beliefs can impact on patients with tension headaches.

Keywords: Brain behavioral system, Metacognitive beliefs, Resilience, Tension headache

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Introduction

Pain serves an essential purpose to warn you of an organ injury, such as a sprained ankle or a hand burn. Psychological therapies are also a necessary part of pain management. Pain and managing thoughts, emotions, and behaviors associated with discomfort can help you cope effectively with pain and reduce your pain. The change in urban lifestyle and its complications, especially stressful conditions can predispose individuals for various diseases such as headaches. More than 90% of people experience headaches at least once a year. Headaches are one of the most common problems which lead to medical visits. Annually, 240 million people worldwide suffer from 1.4 billion headache attacks. For this reason, headaches are an essential target for public health interventions. Headaches manifest in two main forms of migraine and tension headaches (1).

Tension headache as the most prevalent type of headache and one of the most common causes of people going to outpatient clinics for neurological diseases is caused by lifestyle, genetic and environmental factors, but its pathology is still unknown (2,3).

Using the diagnostic criteria of the International Headache Society, Rasmussen et al. reported a 78% (69% of men and 88% of women) lifelong stress for tension headaches. This study showed that the incidence and prevalence of tension headaches are much higher than previously thought (4).

These headaches can be mild and not very short-time or severe and long-lasting. New research has shown that social activities are impaired in about 60% of these patients (5,6), and severe and recurrent headaches limit daily life activities, reducing the quality of life, and productivity (7).

These headaches are characterized by unbearable bilateral pain (pressure or stiffness, pain similar to a bandage or hat), mild or moderate pain that can interfere with personal activities. Many chronic headaches are associated with psychological and behavioral problems. Depression and anxiety are one of the leading causes of hospitalization in patients with chronic headaches (7,8).

Psychosomatic symptoms always have a hidden message. Their purpose is the same: to "escape" from a complex, stressful or painful situation. Psychotic symptoms can be thought of to connect a "self-suffering" person to those around them. Although these symptoms are somewhat complex, they can be seen as a cry for help. Theoretical advances and growing research have provided the basis for conceptualizing headaches as a psychosomatic disorder. Also, biological agents alone cannot explain the vulnerability to the experience of headache disorder, the time of its onset, and the course it undergoes, accelerating and exacerbating its attacks or disease-related disabilities (9).

Tension headaches are the most common type of headache, and both have a significant social and economic impact on society. The global prevalence of tension headaches is 42%, and migraine headaches are 12%. In international studies, headaches are the second most common disorder globally, leading to economic costs of $ 1.6 billion (10). Anxiety and worry, leads to the intrusion of headache feelings, which can become migraine headaches by becoming chronic and not paying attention to personality changes (11). Although it is unclear whether psychological factors cause headaches or secondary to long-term headaches, stress, anxiety, and depression playing a significant role in tension headaches. In this regard, 80% of patients with tension headache have dysfunction to work or other activities due to headaches (12).

Resilience, as a popular field in recent years, has been used to study and discover individual and interpersonal abilities. Research has shown that some resilient individuals return to normal performance levels after facing a difficult life situation, while others recover from past failures and difficulties (13). Campbell-Sills et al. stated that resilient individuals could develop and expand a set of coping skills that support them in challenging situations (14).

In this regard, one of the theories that have been used as a basis for describing and explaining differences in individual and psychological pathology is the theory of sensitivity to reinforcement, which was proposed by Jeffrey Gray. Based on this theory, personality cannot be considered apart from brain-behavioral systems. RST-based people are born with different levels of sensitivity to brain systems, which are genetically and biologically determined, but are also affected by environmental and learning components throughout life (15). Gray reviewed the texts of animal studies in the Reinforcement Sensitivity Theory (RST) of personality and presented a

biological model that includes three behavioral brain systems. Belief in these behavioral brain systems is the basis of individual difference and the activity of each of them leads to different emotional reactions, such as irritability, anxiety, and fear. In contrast, the behavioral inhibition system is activated in the face of signs of punishment and the lack of rewards and new stimuli to create responses related to inhibition and behavioral avoidance and create feelings of anxiety and arousal (16,17).

The third system is the anti-escape system, anti-aggression (defense aggression), and escape (rapid escape from the source of punishment), which are known as behavioral activation systems, respectively (18).

The metacognitive approach believes that individuals, due to a cognitive pattern, also metacognitive therapy, including two broad areas of content. Each disorder within these domains has its content. These broad areas include positive and negative metacognitive beliefs. The metacognitive approach also focuses on positive and negative metacognitive beliefs. Positive metacognitive beliefs relate to the benefits and advantages of engaging in cognitive activities that constitute cognitive-attentional signaling and negative metacognitive beliefs to the uncontrollability, meaning, importance, and dangerousness of cognitive thoughts and experiences. According to the metacognitive model, the activation of dysfunctional metacognitive beliefs leads to a negative evaluation of disturbing thought as a sign of threat (19).

This evaluation also exacerbates negative emotions; thus, the person uses mindfulness strategies to reduce anxiety and control his/her cognitive system and eventually becomes impaired (20).

Patients with headaches are more vulnerable to life's adversities (21), also, their resistance can impact on the formation and exacerbation of headache attacks (22). So, successful adaptation to the adverse environmental conditions in these patients is necessary (23).

Based on the conducted studies, there are high levels of catastrophe and rumination in patients with chronic pain (3). In addition, the relationship between emotion and severity of perceived pain is not a simple linear relationship; and metacognitive beliefs can affect this relationship (24). The present study aimed to assess the activity of brain-behavioral systems and resilience through the mediating role of metacognitive beliefs in patients with tension headaches.

Materials and Methods

The statistical population of this descriptive-correlational study consisted patients with tension headaches who referred to specialized clinics and offices of neurologists and clinical psychologists in Mashhad city during July 2018 to May 2019. Among them, based on the sample size estimation, three hundred patients were selected by the convenient sampling method. Inclusion included having at least intermediate degree, completing the consent form, having a history of at least ten attacks with long-term headache characteristics last 30 minutes to 7 days after the onset, and having a diagnosis of tension headache under the supervision of a neurologist. Exclusion criteria also included having major psychiatric disorders, neurological disorders or chronic physical illness, substance abuse, and refuse to continue the research.

Research instrument

A) Jackson's Five-Factor Questionnaire: To evaluate the behavioral brain systems, the Persian version of Jackson's five-dimensional functional questionnaire was used. This questionnaire measures 30 items. Jackson has calculated its reliability using the Cronbach's alpha method for each of these systems: Behavioral Activation System equal to 0.83, Behavioral Inhibition System 0.76, and total fight-flight system equal to 0.74, respectively. Hassani, Salehi, Rasouli in 2012 translated it into Persian. The psychometric properties of the Persian version of this questionnaire reported acceptable (25).

B) Connor and Davidson Resilience Questionnaire: This questionnaire was developed in 2003. This questionnaire has 25 items responded in five-option degree (26). In Iran, Mohammadi has translated it and Samani, Jokar, and Sahragard, assessed its reliability equal to 0.87 using Cronbach's alpha coefficient. The correlation of each item with the total score of the coefficients ranged 0.41 and 0.64 (27).

C) Metacognitive Questionnaire (MCQ-30): This questionnaire is a 30-item self-reported scale to measure people's beliefs about their thinking by Wells and Catherine-Hutton (2004). The items answered based on a four-point Likert scale (1: I don't agree to 4: I agree

completely). This scale has subscales include positive beliefs about anxiety, beliefs about uncontrollability and risk thinking, beliefs about the need to control thoughts and beliefs about cognitive confidence. In terms of validity of this questionnaire, Cronbach's alpha coefficient ranges 0.73 to 0.93, and reliability after 18 to 22 days for the total scale reported equal to 0.75, and for the subscales 0.59 to 0.87 (28). In the present study, the reliability coefficient using Cronbach's alpha reported 0.82 the total scale, while it calculated for positive metacognitive beliefs equal to 0.78, uncontrollability and risk 0.76, the need to control thoughts 0.63, and cognitive confidence equal to 0.70. The data analyzed by the descriptive statistics, Pearson correlation method, path analysis, AMOS and SPSS version 22.

Results

According to the findings, 292 patients (186 women and 106 men) completed the questionnaires. The highest number of the patients aged 24-28 years, while the lowest number of the patients aged 54 years and older. Also, most of the patients were married (64%), and 64.53% of them had diploma. Only four patients had Ph.D. degree. In term of taking medicine, 79 patients (25.68%) have used drugs.

Table 1 showed the descriptive results related to the scores of the brain behavioral systems, resilience, and metacognitive beliefs in patients with tension headaches.

The structural equation modeling related to brain-behavioral systems and resilience is presented in Table 2.

Table 1. The descriptive results of the variables

Variable	Mean	Standard deviation
Resilience		
Competence	13.69	8.87
Instincts	11.24	7.35
Affection	9.49	5.95
Control	5.20	3.68
Spirituality	2.00	1.58
Total	41.63	5.52
Metacognitive beliefs		
1	12.83	3.70
2	13.03	3.52
3	12.60	4.18
4	12.64	4.09
5	14.82	4.64
Total	65.92	12.28
Brain behavioral system		
BIS	12.77	6.52
BAS	14.81	6.85
FL	15.55	6.94
FI	15.91	7.32
FR	15.69	7.05

Table 2. Structural equation modeling results related to brain-behavioral systems and resilience

Variable	Route coefficient (non-standardized)	Route coefficient (standardized)	Standard estimation error	Critical statistics	P
BAS on resilience	-0.883	-0.249	0.308	-2.870	0.004
BIS on resilience	-0.529	-0.140	0.252	-2.100	0.036
FFFS on resilience	1.79	0.460	0.400	4.470	0.000

According to Table 2, BAS on resilience has an impact factor equal to -0.883 (non-standardized) that the critical statistic related to the direct effect of BAS on resilience (-2.870) is negative and significant at the level of 0.05. So, BAS has a direct and negative impact on resilience. According to Table 1, BIS on resilience has an impact factor of -0.529 (non-standardized). The critical statistic related to the direct effect of BIS on resilience (-2.100) is negative and it is significant at the level of 0.05.

That is, BIS has a direct and negative impact on resilience. Also, FFFS on resilience has an impact factor equal to 1.79 (non-standardized). The critical statistic related to the direct effect of FFFS on resilience (4.470) is positive and significant at the level of 0.05. That is, FFFS has a direct positive impact on resilience. Table 3 presented the structural equation modeling related to brain-behavioral systems and metacognitive beliefs in patients with tension headache.

Table 3. Structural equation modeling related to brain-behavioral systems and metacognitive beliefs

Variable	Route coefficient (non-standardized)	Route coefficient (standardized	Standard estimation error	Critical statistics	P
BAS on metacognitive beliefs	0.207	0.140	0.219	0.930	0.352
BIS on metacognitive beliefs	0.160	0.100	0.181	0.863	0.388
FFFS on metacognitive beliefs	-1.007	-0.620	0.271	-3.710	0.000

According to Table 3, BAS of metacognitive beliefs has an impact factor equal to 0.207 (non-standardized) that the critical statistic related to the direct effect of BAS on metacognitive beliefs (0.930) is positive and not significant at the level of 0.05. That is, BAS has no direct impact on metacognitive beliefs. Also, according to the results of BIS on metacognitive beliefs, the impact factor is 0.16 (non-standardized) that the critical statistic related to the direct effect of BIS on metacognitive beliefs (0.863) is positive and not significant at the level of 0.05. That is, BIS has no direct positive impact on metacognitive beliefs. In addition, FFFS on metacognitive beliefs has an impact factor equal to -1.007 (non-standardized). The critical statistic related to the direct effect of FFFS on metacognitive beliefs (-3.710) is negative and significant at the level of 0.01. So, FFFS has a direct negative impact on metacognitive beliefs.

Discussion

Based on the findings, 292 patients with tension headache participated in this study. It is indicated that BIS and BAS have a negative and direct impact on resilience, while FFFS has indirect and positive impact on resilience. On the other hand, although BIS and BAS have not a significant impact on metacognitive beliefs, Many studies indicated a correlation between between the behavioral brain system and multiple variables and the role of mediating variables. Some studies, such as the present study, have examined the relationship between behavioral brain systems in explaining physical disorders. The imbalance of these systems is associated with some psychiatric and psychosomatic disorders (29), such as substance abuse, antisocial behavior (20), pervasive anxiety disorder (8), ADHD (16), and depression (18). It was also found that there was a direct relationship between brain-behavioral systems and metacognitive beliefs in patients with tension-type headaches. In this field, Swanson et al. showed that high levels of impaired metacognitive knowledge have a significant and positive relationship with mood swings (21). In general, the results of this study are consistent with the direct effect of BIS and BAS on resilience with some studies. Haj Norouzi showed the simultaneous regression of the self-control variable with the coefficient (0.09) of prediction and also BIS, BAS with the coefficient of determination (0.15), respectively predicted the variables of self-control and resilience (30).

Also, the conducted studies have shown that there is a relationship between brain-behavioral systems and metacognitive beliefs (24).

These results are consistent with our research. As observed in the findings of this study, metacognitive beliefs play a mediating role between brain-behavioral systems and resilience. This study was limited to people with tension headaches referred to clinics related to pain and neurology and psychiatric centers in Mashhad city, Iran.

Therefore, it is suggested that considering the increasing prevalence of psychosomatic disorders, due to the stressful conditions of society, it is recommended that the comprehensive studies with higher sample size and having a control group be conducted to increase our knowledge about psychosomatic disorders. Also, non-randomized sampling method and self-report instrument are other limitations.

Conclusion

According to the results of the present study, behavioral inhibition system and behavioral activation system have a negative and direct impact on resilience, while FFFS has indirect and positive impact on resilience. Although BIS and BAS have not a significant impact on metacognitive beliefs, FFFS has a direct and significant impact on metacognitive beliefs. Also, brain behavioral systems and resilience through mediating role of cognitive beliefs can impact on patients with tension headaches.

Acknowledgment

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