



Predicting Pain Intensity based on Pain Metaphorical Perception with the Mediating Role of Cognitive Emotion Regulation in Women with Dysmenorrhea

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Authors

Helma Darbandi¹
leila Zoghi*²

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ABSTRACT

Aims: The purpose of the present study was to predict pain intensity based on pain metaphorical perception with the mediating role of cognitive emotion regulation in women with dysmenorrhea.

Method and Materials: This cross sectional study was applied in terms of correlation using structural equation modeling. The statistical population of the present study was all girls in Tehran in the last six months of 2024 who suffered from menstrual pain. According to the inclusion criteria, 250 women with menstrual pain were selected from Tehran through available and voluntary sampling. The participants completed the questionnaires on Pain Intensity, Pain Metaphorical Perception, and Cognitive-emotional Regulation. Data analysis was conducted using SPSS version 26 and Amos version 24 software.

Findings: Women's negative and positive cognitive emotion regulation strategies mediate the relationship between pain metaphorical perception and women's pain intensity, with the difference that positive cognitive emotion regulation strategies, as a mediator, reduce the effect of pain metaphorical perception on women's pain intensity. However, negative cognitive emotion regulation strategies as mediators increase the impact of pain metaphorical perception on women's pain intensity (P=0.005).

Conclusion: Results indicated that pain intensity is predictable based on pain metaphorical perception, with the mediating role of cognitive emotion regulation in women with dysmenorrhea.

Keywords: Pain Metaphorical Perception, Cognitive Emotion Regulation, Pain Intensity, Women with Dysmenorrhea

Introduction

Pain is an unpleasant internal sensation that is often caused by tissue damage⁽¹⁾. Most illnesses cause pain, but different people react differently to pain and its types⁽²⁾. The suffering and disability resulting from intractable pain reduce the quality of life for many people⁽³⁾. Hence, pain is associated with psychological aspects such as anxiety and cognitive aspects such as cognitive flexibility⁽⁴⁾. Pain is interpreted as an unpleasant stimulus resulting from potential or actual tissue damage⁽⁵⁾. The intensity of the pain initially serves as a warning. But after it becomes chronic, it loses its warning and adaptive role and becomes the beginning of many problems for the person suffering from pain⁽⁶⁾. Chronic pain, in addition to inflicting physical suffering, can problems⁽⁷⁾. The worsening of

chronic pain is one of the most important medical problems in today's complex industrial and urban world⁽⁸⁾. Women with menstrual pain often change their activity patterns to minimize pain intensity and maximize their resilience to pain⁽⁹⁾. Patients with chronic and recurring pain, such as menstrual cramps, resort to conceptual or cognitive metaphors to express their pain because their pain is deep-seated and has no external symptoms⁽¹⁰⁾. The principle of conceptual metaphors stems from psychology⁽¹¹⁾ and the cognitive science approach to language and is based on Lakoff's theory. Cognitive linguistic studies have introduced a new view of metaphors, according to which they are not merely also lead to various psychological literary devices or purely verbal features. Rather, they are

¹ Clinical Psychology, Islamic Azad University. Electronics Branch. Tehran, Iran

² Department of Psychology, Amin University of Law Enforcement Sciences, Tehran, Iran



* Correspondence

Department of Psychology, Amin University of Law Enforcement Sciences, Tehran, Iran.

P.O. 88351730-37

Tel : 00982188021527

Fax : 00989339708496

E-mail: zoghi@yahoo.com

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considered a completely active linguistic-verbal process in the human cognitive system⁽¹²⁾. Lakoff and Johnson⁽¹³⁾ believed that conceptual metaphors in any semantic domain have two basic components: source and target domains. Based on the source domain, the status of the target domain (an abstract-conceptual mental base) is determined. To understand the meaning, relationships, called requirements or mappings, are established between the source and destination domains. In other words, mappings, or connections between abstract and concrete concepts (grounded in the empirical world), facilitate understanding of concepts⁽¹⁴⁾. Therefore, conceptual metaphors have an epistemological-cognitive characteristic⁽¹⁵⁾. A study showed that Persian speakers express their pain using the source domains of object, causality, path, and direction, human, place, taste, container, force, and circle⁽¹⁶⁾. Furthermore, conceptual metaphors of pain are like a bridge between the patient and the doctor for diagnosis and treatment⁽¹⁷⁾. A study indicated that the relationship between pain intensity and metaphorical perception of pain is significant⁽¹⁸⁾. Another study showed lived experiences of pain in cancer patients are the main themes of metaphors, including the metaphors of lived war, scheduled pain cage, living in a dark future with pain, and the overload pain⁽¹⁹⁾.

Pain intensity may enhance maladaptive aspects of cognitive emotion regulation, as this process plays an important role in our adaptation to life events⁽²⁰⁾. The most common of these strategies is emotion regulation using cognitive strategies. Cognitive processes help people regulate their emotions and feelings, avoid being overwhelmed by the intensity of everyday emotions and stress, and thus improve their psychological well-being⁽²¹⁾. Emotion regulation is an inherent aspect of individuals' emotional response tendencies and a form of self-regulation. Emotion regulation refers to actions used to change or modify an emotional state⁽²²⁾. One study found that overall emotion regulation (specifically, identifying and describing emotions), in addition to specific pain experiences, influences the

perception of pain intensity⁽²³⁾. One study showed that several psychological variables, such as anxiety, depression, and emotion regulation constructs, were significantly associated with pain catastrophizing and distress intolerance towards pain⁽²⁴⁾.

The results of the studies mentioned here suggest that cognitive aspects of pain (metaphors), along with emotional aspects (cognitive emotion regulation), and, in parallel, behavioral aspects of pain (pain intensity), may influence the perception of pain in women with menstrual pain. There is no place in the research literature for studies like this that look at menstrual pain from different aspects. Therefore, the researcher in this study seeks to answer the question: Can pain intensity be predicted from metaphorical pain perception, with cognitive emotion regulation as a mediator, among women with dysmenorrhea?

Method and Materials

The method of this study was applied in terms of purpose and descriptive in terms of correlation using structural equation modeling. The statistical population of the present study was all girls in Tehran in the last six months of 2024 who suffered from menstrual pain. Researchers recommend a ratio of 10 observations per independent variable for structural equation modeling in educational sciences⁽²⁵⁾. In these models, it is always emphasized that the sample size should be at least 200 people. For this purpose, 250 women with menstrual pain were selected from Tehran through non-random sampling (available and voluntary). The inclusion criteria for the study were being between the ages of 16 and 40, and having menstrual pain for at least 6 months. The exclusion criterion was the participants' declaration of unwillingness to continue cooperation. For this purpose, after obtaining permission from the university, the researcher visited medical centers in Tehran and, after making the necessary arrangements with the relevant units, requested that the link to the study's questionnaires be sent to women experiencing menstrual pain. In this study, all ethical principles, including

confidentiality, were observed. Data analysis was conducted using SPSS version 26 and Amos version 24 software. The following tools were used in this study:

Pain Intensity Questionnaire: This questionnaire was developed by Von Korff et al.⁽²⁶⁾ to measure the severity of chronic pain. This questionnaire assesses three dimensions: pain intensity, pain stability or duration, and the degree of disability resulting from pain. The respondent rates each of the seven test questions on an eleven-point scale from 0 to 10. The individual's score on the questionnaire is calculated across three subscales: pain intensity, disability score, and degree or level of disability. The minimum possible score in this questionnaire is 0, and the maximum is 70. The Cronbach's alpha coefficient for this scale was reported to be 0.68. In Iran, the construct validity of the questionnaire was confirmed using exploratory and confirmatory factor analysis methods. The questionnaire's internal consistency criteria were also acceptable. Cronbach's alpha for the entire questionnaire was 0.87⁽²⁷⁾. The validity of this questionnaire, as measured by Cronbach's alpha coefficient in this study, was 0.89.

Pain Metaphorical Perception Questionnaire: This questionnaire was developed by Raiisi⁽²⁸⁾ and comprises 25 questions designed to measure metaphorical perception of pain. This questionnaire has three subscales: object, force, human, and causality. The questionnaire is scored on a Likert scale (with a scoring method of 5: completely agree to 1: completely disagree). The minimum score on the entire questionnaire is 25, and the maximum is 125. The validity of the questionnaire has been confirmed through content validity and expert opinion using the Waltz and Bassel method. The entire questionnaire had a Cronbach's alpha of 0.75, indicating good internal consistency. The validity of this questionnaire, as measured by Cronbach's alpha coefficient in this study, was 0.89.

Cognitive-emotional regulation questionnaire: This questionnaire was developed by Garnefski et al.⁽²¹⁾ to assess the cognitive strategies individuals use after experiencing

life-threatening events or stressors. This questionnaire has 18 questions and aims to measure the subscales of cognitive emotion regulation (self-blame, acceptance, rumination, positive refocusing, refocusing on planning, positive reappraisal, perspective-taking, catastrophizing, and blaming others). Among these strategies, self-blaming, blaming others, rumination, and catastrophic thinking are negative emotion regulation strategies. The strategies of acceptance, refocusing on planning, positive refocusing, positive appraisal, and reaching a perspective represent positive emotion regulation strategies. The scoring method is Likert-type, from never = 1 to always = 5. The score for each strategy is obtained by summing the scores for each statement that makes up that strategy, and it can range from 4 to 20. The total score ranges from 36 to 180. In a study of the test's psychometric properties, Garnefski et al. (2009) reported subscale Cronbach's alpha coefficients ranging from 0.87 to 0.93. The reliability of the test was calculated using Cronbach's alpha coefficient for the entire test, which was 0.91. In Iran, the validity of the test was also examined by correlating the total score with the test's subscale scores, which ranged from 0.40 to 0.68, with an average of 0.56; all correlations were significant⁽²⁹⁾.

Findings

In this study, 250 women participated, with a mean age of 32.17 and a standard deviation of 4.45. Of these women, 64 percent had a bachelor's degree. Table 1 presents the descriptive characteristics of the variables.

To investigate the prediction of pain intensity based on pain metaphorical perception with the mediating role of cognitive emotion regulation in women with dysmenorrhea, the bootstrap and regression methods were used. The direct effect of the metaphorical perception of pain, with the standardized beta coefficient, on pain intensity is negative (Beta = -0.405). The direct effect of negative cognitive emotion regulation strategies on pain intensity (Beta = 0.570) is positive. The direct effect of positive cognitive emotion regulation strategies on pain intensity

(Beta = -0.547) is significant (P = 0.001). Furthermore, the direct effect of pain metaphorical perception, with the standardized beta coefficient, on negative cognitive emotion regulation strategies (Beta=-0.305) is significantly negative, and on positive cognitive emotion regulation strategies (Beta=0.365) is significantly positive (P<0.001). The direct effects of the variables of pain metaphorical perception and cognitive emotion regulation on women's pain intensity are shown in Table 2.

The indirect effect of metaphorical perception of pain on pain intensity in women, with the mediating role of negative cognitive emotion regulation strategies, is significant, with an effect size of 0.17 (P=0.007). Furthermore, the indirect effect of metaphorical perception of pain on women's pain intensity, mediated

by positive cognitive emotion regulation strategies, is significant, with an effect size of -0.20 (P=0.005). As a result, women's negative and positive cognitive emotion regulation strategies mediate the relationship between pain metaphorical perception and women's pain intensity, with the difference that positive cognitive emotion regulation strategies, as a mediator, reduce the effect of pain metaphorical perception on women's pain intensity. However, negative cognitive emotion regulation strategies as mediators increase the effect of pain metaphorical perception on women's pain intensity. The results of the bootstrap test to determine the mediating role of women's cognitive emotion regulation in the relationship between pain metaphorical perception and pain intensity are presented in Table 3.

Table 1) Mean and standard deviation of variables

Variables	Minimum	Maximum	Mean	SD
Total pain intensity score	31	239	109.51	42.771
The total score of pain metaphorical perception	25	115	58.29	17.668
Negative cognitive emotion regulation strategies	7	69	17.82	8.331
Positive cognitive emotion regulation strategies	7	110	34.78	15.852

Table 2) Direct effects of pain metaphorical perception, and cognitive emotion regulation variables on women's pain intensity

Direct effects of variables	Beta	B	SE	T	Sig.
Pain metaphorical perception ---> Pain intensity	-0.405	-0.830	0.102	-8.099	0.001**
Negative cognitive regulation strategies ---> Pain intensity	0.570	3.135	0.286	10.944	0.001**
Positive cognitive emotion regulation strategies ---> Pain intensity	-0.547	-1.613	0.156	-10.309	0.001**
Pain metaphorical perception ---> Negative cognitive regulation strategies	-0.305	-0.129	0.023	-5.652	0.001**
Pain metaphorical perception ---> Positive cognitive emotion regulation strategies	0.365	0.287	0.042	6.791	0.001**

(**) Significance at the 0.01 level and (*) significance at the 0.05 level.

Table 3) Results of the bootstrap test to determine the mediating role of cognitive emotion regulation in the relationship between pain metaphorical perception and pain intensity.

Independent variable	Mediating variable	Dependent variable	Resampling	Estimation error	Effect size	P.Value
Pain metaphorical perception	Negative cognitive regulation strategies	Pain intensity	2000	0.066	0.17	**0.007
Pain metaphorical perception	Positive cognitive emotion regulation strategies	Pain intensity	2000	0.068	-0.20	**0.005

Discussion

The purpose of the present study was to predict pain intensity based on pain metaphorical perception with the mediating role of cognitive emotion regulation in women with dysmenorrhea. The results indicated that pain intensity is predictable based on pain metaphorical perception, with the mediating role of cognitive emotion regulation in women with dysmenorrhea. Women's negative and positive cognitive emotion regulation strategies mediate the relationship between pain metaphorical perception and women's pain intensity, with the difference that positive cognitive emotion regulation strategies, as a mediator, reduce the effect of pain metaphorical perception on women's pain intensity. However, negative cognitive emotion regulation strategies as mediators increase the effect of pain metaphorical perception on women's pain intensity. The results of this study are consistent with the findings of Raiisi⁽¹⁷⁾, Bolkhari et al.⁽¹⁸⁾, Aaron et al.⁽²³⁾, and Yuan et al.⁽²⁴⁾. The difference between this study and previous studies is that this study refers to conceptual metaphors as a new variable in this field.

In explaining this finding, it can be said that positive and negative cognitive emotion regulation strategies facilitate pain intensity and metaphorical pain perception. People who use positive cognitive emotion regulation strategies, such as positive reappraisal, show greater resilience during intense pain⁽³⁰⁾. They often try to change their interpretation of pain⁽³¹⁾. These interpretations are mainly metaphorical. In other words, the ability to regulate cognitive emotion helps people develop greater resilience and cognitive flexibility in difficult, stressful situations of high pain intensity and recover quickly from such situations⁽³²⁾. All of these factors, including psychological and cognitive ones, are present in this study, where conceptual metaphors play a significant cognitive role⁽³³⁾. Preliminary evidence, mainly from qualitative studies and clinical observations, suggests that women widely use metaphors such as "ripping," "pushing," or "painful waves" to describe their menstrual pain, which reflect not only the intensity of the pain but also how

it is cognitively and emotionally perceived.⁽³⁴⁾ In parallel, early research emphasizes the role of emotion regulation; for example, women who use maladaptive strategies such as rumination or catastrophizing report greater pain intensity and disability, while employing strategies such as cognitive reappraisal and acceptance is associated with reduced emotional distress and improved ability to cope with pain⁽³⁵⁾. These initial findings challenge the traditional purely physiological view and emphasize the need to consider metaphorical perception and emotional processing as important targets of therapeutic interventions for menstrual pain.

One limitation of this study is the lack of cooperation from women due to menstrual problems. Often, younger women were reluctant to comment on their menstrual problems. To gain the women's consent, they were assured that their information would remain confidential. In future studies, researchers are advised to pay more attention to psychological factors and sensitivities of women with dysmenorrhea. Similar studies with psychological and interdisciplinary variables are needed to be conducted on women with dysmenorrhea and to examine different factors from different dimensions in different studies. Furthermore, the discussion would benefit from addressing potential confounding variables (e.g., pain duration, treatment history), and the cross-sectional design precludes causal inference. In this study, the indirect effect of metaphorical pain perception on pain intensity in women, with the mediating role of negative and positive cognitive regulation strategies, was found in women with low emotional dysmenorrhea. It is suggested that similar studies be conducted in similar clinical samples in future studies. Given that the present study design is cross-sectional, any causal interpretation of the relationships between variables – including the mediating role of cognitive emotion regulation in the relationship between metaphorical perception of pain and pain intensity – should be made with great caution. To confirm the reported mediation role and test the proposed causal model, it is necessary to conduct longitudinal studies that measure

variables at multiple time points, as well as experimental research (such as clinical trials of emotion regulation strategy training).

Conclusion

The direct effect of metaphorical perception of pain on pain intensity is negative; the direct effect of negative cognitive emotion regulation strategies on pain intensity is positive; and the direct effect of positive cognitive emotion regulation strategies on pain intensity is significant and negative. Women's negative and positive cognitive emotion regulation strategies mediate the relationship between pain metaphorical perception and women's pain intensity, with the difference that positive cognitive emotion regulation strategies, as a mediator, reduce the effect of pain metaphorical perception on women's pain intensity. However, negative cognitive emotion regulation strategies as mediators increase the effect of pain metaphorical perception on women's pain intensity. Researchers are advised to conduct intervention studies that include interdisciplinary factors in the field of metaphor and cognitive regulation of emotion, which can affect pain intensity.

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Authors' contribution

The first author of this article serves as the principal investigator. The second author served as the supervisor of this thesis and the corresponding author.

Conflict of interest

The authors declare no conflict of interest for this study.

Ethical Considerations

All ethical principles, including confidentiality, were observed in this study. In addition, this study has been registered with the ethical code IR.IAU.TNB.REC.1403.265 at Islamic Azad University - North Tehran Branch.

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