

The structural model of pain, cognitive strategies, and negative emotions in functional gastrointestinal disorders

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Background: Patients with functional gastrointestinal disorders (FGIDs) may use specific coping strategies. We intend to provide a mediating role of the relationship between pain (intensity and acceptance), cognitive emotion regulation strategies, and negative emotions in patients with FGIDs. **Materials and Methods:** Participants were 176 inpatients, all experiencing significant FGIDs symptomatology as confirmed by gastroenterologists. Patients completed data on cognitive emotion regulation questionnaire, short form of depression, anxiety, stress scale, chronic pain acceptance questionnaire-revised, and pain intensity scale. Data were analyzed using structural equation modeling method. **Results:** The pain intensity had significantly direct effect on cognitive emotion regulation strategies and indirect effect on negative emotions. Besides, the mediating role of negative emotions in the relationship between the strategies and pain acceptance were supported, whereas indirect relationships between pain intensity and acceptance through cognitive strategies were not confirmed. **Conclusion:** The results of the study emphasize the role of pain intensity in the development of negative emotions through cognitive strategies and the role of the strategies in pain acceptance through negative emotions. In fact, cognitive strategies to be related to pain and emotions.

Key words: Functional gastrointestinal disorders, negative emotion, pain, strategies

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INTRODUCTION

Pain or discomfort is a key feature of many functional gastrointestinal disorders (FGIDs) and is typically either the primary outcome variable or an important secondary outcome variable in clinical trials.^[1] FGID patients show a lower threshold to painful somatic stimulus. They may have hyperalgesia and low pain tolerance that are not limited to the viscera, but that is part of a systemic general condition.^[2]

Pain has two dimensions of unpleasant sensory and emotional experience. Sensory dimension refers to pain intensity, and affective dimension refers to the unhappiness that a person is experiencing.^[3] Due to

developing considerable stress, pain calls negative emotions and causes lower quality of life.^[4] The typical emotional reaction to pain includes anxiety, fear, anger, guilt, frustration, and depression.^[5] When people with chronic pain respond this way, their overall level of distress may increase, they may avoid their emotional experiences, and their daily functioning may decrease.^[6]

It has been showed that there are the relations between pain unpleasantness and negative emotions in patients with chronic pain.^[7] Pain-related emotions are triggered by the immediate unpleasantness of pain.^[8] Hence, pain acceptance demonstrates a negative correlation with pain-related anxiety, and it is the strong predictor of pain-related avoidance.^[9] A survey was accomplished on the relationship between chronic pain acceptance and

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affective well-being from a coping perspective. Its findings showed that pain willingness (the attitudinal component of pain acceptance including the recognition of the uncontrollability of pain) primarily reduces negative affect, whereas activity engagement (the behavioral component of pain acceptance including the pursuit of life activities despite pain) additionally produces positive affect.^[10]

The idea that pain can lead to feelings such as frustration, worry, anxiety, and depression seems obvious, particularly if it has a chronic nature. However, there is also evidence for the reverse causal relationship in which negative mood and emotion can lead to pain or exacerbate it.^[11] For example, it is showed that doubt in emotion expression,^[12] dysfunctional anger management,^[13] fear,^[14] and depression^[15] correlate with pain intensity. The diminution of negative emotion following a period of high negative emotion predict reduced pain, whereas greater variability of negative emotion predicts higher pain and increased activity limitation.^[16] Studies indicating affective disordered persons demonstrate a hyperalgesic response to pain sensation.^[17] Negative emotions come into view to correlate in a positive direction with pain sensitivity.^[18]

From the above-mentioned findings, two types of studies examine the interface between pain and emotions: (a) pain provokes negative emotions, and (b) negative emotions cause or exacerbate pain. However, it has documented that pain does not always correlate with increased negative affect.^[19] The capacity to self-regulate emotion may be the key difference between those who endure a great deal of pain-related suffering and those who can separate the experience of pain from emotional responses to pain.^[20]

Hence, emotion regulation is assumed to be an important factor in determining well-being.^[21] The term emotion regulation covers strategies to reduce, maintain, or increase an emotion.^[22] Cognitive emotion regulation refers to the conscious and cognitive way of handling emotionally arousing information.^[21] Investigations have shown that the regulation of emotions by cognitions or thoughts is inextricably associated with human life and helps people to keep control over their emotions during or after the experience of threatening or stressful events^[21,23] such as pain experience. Thus, if pain is the bad news, the good news is that there are numerous strategies for regulating pain and the negative emotions associated with the anticipation and experience of pain.^[24]

Emotion regulation strategies may have different profiles of benefits. Some studies have investigated the strategies employed in regulating unpleasant emotions^[25-27] and pain sensation.^[28,29] Furthermore, research has identified specific strategies associated with better and worse mental

health outcomes applying classifications as adaptive and maladaptive, respectively. Adaptive strategies (i.e., perspective, reappraisal, behavioral activation, positive refocusing, social support, planning, and benefit finding) are associated with higher mood ratings than the use of maladaptive strategies (i.e. rumination, self-blame, other-blame, substance use, expressive suppression, emotional suppression, denial, and nonsuicidal self-injury).^[30]

According to the existing research resources, the cognitive emotion regulation strategies are associated with emotions and pain sensation. Hence, it is proposed that these strategies can mediate the interfaces between pain and emotions. However, research about the role buffering of emotion regulation strategies in somatic illness is relatively low, and a study in FGID patients and/or in the Iranian community has not been conducted to date. Hence, we intended to provide a mediating role of the relationship between pain (intensity and acceptance), cognitive emotion regulation strategies, and negative emotions in FGID patients. For this purpose and based on the existent research and theoretical background, a conceptual model was selected and was evaluated using structural equation modeling (SEM) method [Figure 1].

MATERIALS AND METHODS

Participants

In this cross-sectional study, participants were 176 inpatients (33 males and 143 females). All of them were experiencing significant FGIDs symptomatology as confirmed by gastroenterologists on the basis of ROME III criteria.^[1] Patients were referred to a digestive psychosomatic clinic in Isfahan, Iran. They were selected by census sampling method (in almost 10 months). For ethics, the researcher assures to patients that their information will remain confidential, then, they received a set of questionnaires to fulfill. The study was conducted within the part of a proposal that was approved by the Ethics Committee of IUMS (287139) and was clarified for all the participants, and a written informed consent was obtained from all participants

Measurements

Short form of depression, anxiety, and stress scale

The initial version of the depression, anxiety, and stress scale (DASS) contains 42 phrases about negative

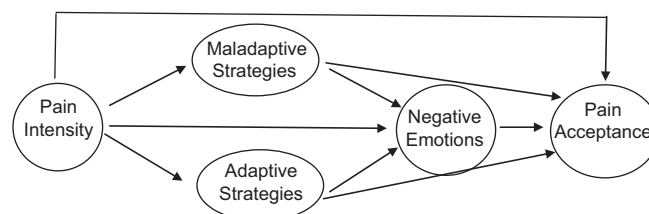


Figure 1: Research theoretical model

emotional states. The scale measures the intensity of depression, anxiety, and stress symptoms and it can be used to assess treatment progression. Participants' intensity rates (frequency) of symptom presented in each phrase which he/she has experienced over the past week on a four-point Likert scale, ranging from 0 (did not apply to me at all) to 3 (applied to me very much).^[31] The internal consistency reliability of short form of the 21-DASS (each of its subscales consists 7 items) was computed in an Iranian sample and Cronbach's α for depression, anxiety, and stress were, respectively, 0.81, 0.74, and 0.78.^[32]

Cognitive emotion regulation questionnaire

The multidimensional cognitive emotion regulation questionnaire (CERQ) was constructed to define what someone thinks after the experience of threatening or stressful events. The CERQ comprises nine conceptually distinct subscales: acceptance, putting into perspective, positive refocusing, planning refocusing, positive reappraisal, catastrophizing, rumination, self-blame, and other-blame. The original scale of the CERQ has 36 items that must be measured on a 5-point Likert scale ranging from 1 (almost never) to 5 (almost always). Score of each subscale can be obtained by summing the scores of items belonging to the particular subscale. The higher the subscale score, the more the specific cognitive strategy is used.^[33] Short 18-item version of the CERQ has the two-item subscales.^[34] In assessing validity and reliability, the Persian version of CERQ-18 has had good psychometric features. Cronbach's alpha coefficients have been estimated for the subscales ranging from 0.68 (acceptance) to 0.82 (planning refocusing).^[35]

Chronic pain acceptance questionnaire-revised

The 20-item chronic pain acceptance questionnaire-revised (CPAQ-R) has been designed to measure the acceptance

of pain. There have been two factors identified in the CPAQ-R: (1) activity engagement (pursuit of life activities regardless of pain), (2) pain willingness (recognition that avoidance and control are often unworkable methods of adapting to chronic pain). The items on the CPAQ are rated on a 7-point scale from 0 (never true) to 6 (always true). The CPAQ-R has demonstrated very good to excellent internal consistency, with alphas of 0.82 (activity engagement) and 0.78 (Pain willingness).^[36] In the Iranian sample, internal consistency of the scale was $\alpha = 0.80$.^[37]

Pain intensity scale

In this study, pain intensity using the subscale of the pain intensity in the multidimensional pain inventory was measured. This subscale consists of three items and its reliability and validity in Iranian patients with chronic pain have been approved. Pain intensity scale must be measured on a 7-point Likert scale ranging from 0 to 6. Higher scores indicate more severe pain.^[38]

Data analyses

Descriptive analysis was indicated as the mean and standard deviation (SD). To examine the structural model between variables, the proposed conceptual model using SEM method was fitted in analysis of moment structures (AMOS) (Byrn, Translated by Hosainzadeh et al, 2011) software.^[39] The parameters of the model have been estimated maximum likelihood method.

RESULTS

A total of 176 respondents with mean \pm SD age of 34.22 ± 10.86 years; 142 (80.6%) female; and 130 (73.8%) married were included in the study. The description of main variables in the current study for participants was presented in Table 1. As can be seen in the table, maladaptive

Table 1: Mean, standard deviation, Cronbach's alpha coefficients, and range of study variables

	Cronbach's alpha coefficients	Mean (SD)	Strategies	Mean (SD)	Range
Cognitive emotion regulation strategies					
Adaptive strategies	0.760	19.92 (5.03)	Acceptance	6.43 (2.03)	0-10
			Planning refocusing	4.78 (1.65)	0-10
			Positive refocusing	6.85 (2.04)	0-10
			Positive reappraisal	6.04 (2.04)	0-10
			Putting into perspective	6.06 (1.77)	0-10
Maladaptive strategies	0.767	28.96 (7.32)	Self-blame	5.82 (2.36)	0-10
			Other-blame	5.58 (2.26)	0-10
			Rumination	7.87 (1.72)	0-10
			Catastrophizing	6.84 (2.11)	0-10
Pain intensity	0.782	-	-	3.24 (1.50)	0-6
Pain acceptance	0.761	-	-	64.42 (14.73)	0-120
Negative emotions					
Anxiety	0.860	-	-	14.58 (9.80)	0-15
Depression	0.829	-	-	14.73 (9.14)	0-21
Stress	0.899	-	-	20.11 (9.95)	0-26

SD = Standard deviation

strategies had higher mean; the highest mean was related to rumination, and the lowest was related to planning refocusing. In relation to the negative emotions, stress had the highest mean.

To examine the relationship between variables, the mentioned conceptual model was fitted in AMOS software. In Figure 2, the fitted model with standard coefficients related to the direct effects of each factor is shown.

The goodness of fit of the model was investigated by statistics of normed fit index, goodness-of-fit index, root mean square error of approximation, and comparative fit index. The statistics amounts of goodness of fit are illustrated in Table 2.

The estimation of standard coefficients of the direct and indirect effects in the model is shown in Table 3. Statistical test of SEM coefficients done using bootstrap method, a nonparametric statistical method based on resampling of the data to estimate the accuracy of the parameters' estimations. In this method, a new sample will be drawn from the original samples by replacement and an estimation of parameters will obtain by fitting the model to the new data. This procedure will be repeated B times to achieve B different estimation of the parameters (in this study B = 1000). The empirical distribution of the parameters estimation can be used as an estimation of their true distribution.

According to Table 3, pain intensity has a direct and significant relationship with maladaptive strategies. In addition, maladaptive strategies have direct and significant relationships with negative emotions, and negative emotions have significant and inverse relationships with

pain acceptance, but pain acceptance does not have a significant relationship with pain intensity. Although pain intensity does not have a significant relationship with adaptive strategies; however, the strategies have significant relationships with negative emotions inversely and with pain acceptance.

Furthermore, there are significant and indirect relationships between pain intensity and negative emotions and each of its factors. In fact, emotion regulation strategies to be considered as the mediating variables between negative emotions and pain intensity. As shown in table, the standard coefficient between adaptive pain intensity and negative emotions 0.323 has been obtained. This means that with increasing severity of pain, maladaptive strategies will increase and as a result, negative emotions will also increase (relationship between pain intensity and negative emotions through

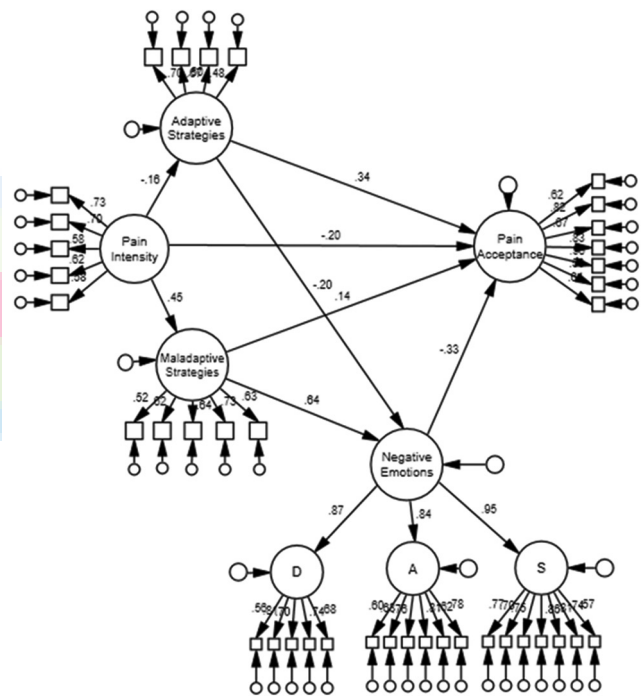


Figure 2: The fitted model with standard coefficients related to the direct effects of each factor

Table 2: The statistics amounts of goodness of fit

	χ^2/df	NFI	CFI	GFI	RMSEA
Value	1.731	0.811	0.872	0.828	0.057
Recommended value*	<3	>0.9	>0.9	>0.9	<0.05

*Shumacker and Lomax (2004). NFI = Normed fit index; CFI = Comparative fit index; GFI = Goodness-of-fit index; RMSEA = Root mean square error of approximation

Table 3: The estimation of standardized coefficients of the direct and indirect effects

	Strategies						Negative emotions			Pain acceptance		
	Maladaptive strategies			Adaptive strategies			Direct	Indirect	Total	Direct	Indirect	Total
	Direct	Indirect	Total	Direct	Indirect	Total						
Pain intensity	0.454*	-	0.454*	-0.157	-	-0.157	-	0.320*	0.320*	-0.197*	-0.094	-0.291*
Maladaptive strategies	-	-	-	-	-	-	0.635*	-	0.635*	0.145	-0.211*	-0.066
Adaptive strategies	-	-	-	-	-	-	-0.196*	-	-0.196*	0.343*	0.065*	0.408*
Negative emotions	-	-	-	-	-	-	-	-	-	-0.331*	-	-0.331*
Stress	-	0.601*	0.601*	-	0.186*	-0.186*	0.946*	-	0.946*	-	-	-
Anxiety	-	0.534**	0.534**	-	-0.165*	-0.165*	0.841*	-	0.841*	-	-	-
Depression	-	0.552*	0.552*	-	-0.171*	-0.171*	0.869**	-	0.869**	-	-	-

*P≤0.05; **P≤0.01

adaptive strategies is not significant because direct relationship between pain intensity and adaptive strategies was not significant). Although there are significant and direct and indirect relationships between pain acceptance and emotion regulation strategies, based on the obtained results, the adequate evidence is not available about a significant indirect relationship between pain intensity and pain acceptance.

DISCUSSION

In accordance with the main aim of the study, we examined the structural model of pain, cognitive emotion regulation strategies, and negative emotions based on the proposed conceptual model in FGID patients. The model emphasized the mediatory role of emotion regulation strategies in the relationship between pain intensity and negative emotions, and on the other hand, relationship pathway of the strategies toward pain acceptance examined through the mediating of negative emotions.

The results showed that there are significant relationships between most factors such as pain intensity and acceptance with emotion regulation strategies, the strategies with negative emotions, and negative emotions with pain acceptance. The findings are in line with some previous studies that have shown the relationship between pain intensity with emotion regulation strategies,^[28,29] emotion regulation strategies with negative emotions,^[26,30,40] and negative emotions with pain acceptance.^[9,10]

The structural model revealed that emotion regulation strategies are as a mediator. Unlike the proposed conceptual model, pain intensity did not have direct relationships with negative emotions. However, there were indirect relationships between them. In fact, emotion regulation strategies to be considered as the mediating variables between pain intensity and emotions (depression, anxiety, and stress). Pain intensity predicts changes in negative emotions only through maladaptive cognitive strategies. This means that the higher severity of pain, the more the maladaptive strategies is used and as a result, negative emotions will increase. These findings are consistent with similar studies emphasizing the mediatory role of emotion regulation strategies in between different psychological and/or somatic factors.^[41-43]

Research has revealed that the employment of adaptive emotion regulation strategies causes a reduction of stress-elicited emotions leading to physical disorders. While dysfunctional strategies, in particular, rumination and suppression appear to be influential in the pathogenesis of depression and physiological disease. In reality, emotional regulation mediates the role between depression and further

psychological and/or somatic illness.^[41] Furthermore, it has shown that emotion regulation strategies have the mediating role on the relationship between attachment styles and alexithymia.^[42] In the intermediate role of cognitive emotion regulation strategies in the relationship between emotional intelligence and individual compatibility, it has found that two emotion regulation aspects, acceptance and rumination, play a significant intermediate role for emotional intelligence and individual compatibility.^[43] Experimental research has also shown that affect-based treatments and/or interventions based on emotion regulation are effective in reduction severity of somatic symptoms in addition to emotional.^[44,45]

Moreover, the model showed that when adaptive/maladaptive cognitive strategies are utilized more/less, negative emotions will decrease/increase, and the higher negative emotions, the less pain acceptance becomes. In the context of pain, acceptance has been found to be associated with decreased pain and distress in response to thoughts about or presentation of a pain-inducing stimulus.^[46] The acceptance of chronic pain is thought to reduce unsuccessful attempts to avoid or control pain and thus focus on engaging in valued activities and pursuing meaningful goals.^[36,47] In fact, chronic pain patients' well-being is closely tied to the maintenance of life activities which presupposes an accepting attitude toward pain.^[48]

The presence of pain as an inner feeling is unpleasant and affects the person adjustment. Hence, it seems reasonable that the more pain intensity, the loss pain acceptance reduces. Regardless of the direct relationship between pain intensity and pain acceptance, it was expected that the study model supports the mediatory role of emotion regulation strategies in the relationships between pain intensity and pain acceptance, but it was not confirmed. In explaining this result, it can be argued that other influential factors (psychological, somatic, and cultural) may affect the relationship between pain intensity and acceptance in FGIDs. In this regard, we can mention that pain in FGIDs is not the main symptom lonely, but it is accompanied with other various and heterogeneous symptoms such as changes in bowel movements, belching, and flatulence. On the other hand, gastrointestinal pains are mostly intermittent and periodic. Alternation of pain accompanied by other symptoms can affect pain acceptance.

The limitations of this study were reliance on self-report data which may recall bias regarding information, and also noncontrolling other factors that may affect the relationships between variables. In addition, investigation of the relationship of each of cognitive strategies with other research variables was not considered due to the complexity of the model. Some indicators of goodness of fit

were slightly lower than the range proposed; this situation suggests adjusting of the model, but there was no possibility of doing it due to the limited sample size.

CONCLUSIONS

The main conclusion of the present study is that the cognitive emotion regulation strategies to be related to pain and emotions as predicted. In fact, the findings revealed the important role of cognitive strategies in physical and psychological health. Hence, take into consideration cognitive strategies for controlling chronic diseases such as FGIDs that psychological factors play a significant role in them can be beneficial. With this aim, interventions based on emotion regulation are promising to improve physical symptoms such as pain. Since maladaptive strategies with pain intensity and adaptive strategies with pain acceptance associated mainly, it seems wise, for targets of intervention to focus not only on reduction utilizing maladaptive strategies but also on increase utilizing adaptive strategies. Additional research is needed to clarify the processes underlying relationship between pain intensity and acceptance.

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Conflicts of interest

There are no conflicts of interest.

AUTHORS' CONTRIBUTION

MM contributed to the conception of the work, conducting the study, drafting and revising the draft, and agreed for all aspects of the work. HRR contributed to the conception of the work, and drafting and revising the draft. MM conducted the statistical analysis. HA contributed to the conception of the work, and drafting and revising the draft. All authors read and approved the final version of the manuscript.

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