Original Article

The causal model of social anxiety of university students based on brain-behavioral systems with mediating of cognitive emotion regulation strategies

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Abstract

Introduction: Social anxiety disorder is one of the most common anxiety disorders and it widely affects social relationships. Hence, it is very important to study its etiology. The purpose of the present study is to evaluate the role of Behavioral Activation/Inhibition Systems (BAS/BIS) in social anxiety symptoms with regard to the mediating role of cognitive emotion regulation strategies.

Materials and Methods: In this correlational-analytic study, 282 students of Quchan branch of Islamic Azad University in the academic year 2018-2019 were selected using multi-stage clustering method. The students answered the Behavioral Inhibition/Activation System (BIS/BAS) scales of Carver and White (1994), Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski, Kraaij and Spinhoven, 2001), and Connor Social Phobia Inventory (SPIN). Structural equation modeling was used to analyze the data.

Results: The findings showed that there is a significant direct relationship between behavioral inhibition system with social anxiety ($\beta=0.29$, $P<0.05$) and cognitive emotion regulation strategies ($\beta=0.34$, $P<0.05$). Moreover, the direct relationship between behavioral activation system and social anxiety is significant ($\beta=-0.19$, $P<0.05$). Data analysis based on structural model indicated an indirect and significant effect between behavioral inhibition system and social anxiety while the effect of behavioral activation system and social anxiety is not significant. The findings supported the appropriate fit of the hypothetical structure among the research variables.

Conclusion: Based on the findings of the study, it can be concluded that high BIS sensitivity and difficulty in emotion regulation leads to maladaptive efforts to regulate, emotional response, and ultimately an increasing risk of psychological disorders such as social anxiety.

Keywords: Behavioral activation/inhibition system, Emotion regulation, Social anxiety.

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Introduction

Anxiety disorders are among the most common disorders in adolescents and young adults. Social anxiety disorder is one of the most important and common types of anxiety disorders (1). This disorder is defined as a chronic and specific fear of one or more social situations in which a person finds him/herself being evaluated by others and is afraid to do something that will humiliate or embarrass him/her (2). Nowruzi et al. reported that the prevalence of this disorder in university students is 5.2%. The results of this study indicated a higher prevalence of social anxiety disorders among females compared to males (3). On the other hand, researchers believe that many stressful situations and problems that cause social anxiety appear at the beginning of adulthood. The stressful situations include living away from family, feeling compelled to make a big decision, identity crisis, communication with others, dealing with social situations, and accepting personal responsibility (4). Eighty-five percent of students with social anxiety suffer from disorders in their academic and professional performance due to lack of communication, interpersonal problems, and difficulties in meeting social needs (5). Also, students may suffer from depression and experience additional stress and anxiety, ultimately affecting their academic and professional performance (6). Many factors have been suggested for the etiology of social anxiety disorder. However, cognitive theories and the theory of brain-behavioral systems are among the leading theories explaining this disorder. Cognitive models of social phobia have been developed based on cognitive literature, extensive clinical work, and the information processing model. These models have conceptualized this disorder as beliefs and cognitive processes that interfere with social functioning and perpetuate social anxiety (7). According to the theory of belief (8), each emotion is represented as a node in an associative network and is linked with other network representations. Activation of an emotion node would lead to increased accessibility of mood-congruent material, which in turn would result in mood-congruent information processing bias (9).

Gray proposed a biological model in Reinforcement Sensitivity Theory (RST) that includes three brain-behavioral systems. Gray believes that these brain-behavioral systems are the basis of individual differences, and the activity of each leads to the evocation of different emotional reactions such as fear and anxiety. The first system is the Behavioral Activation System (BAS), which structurally includes several dopaminergic pathways and corticostriatal-pallido-thalamic (CSPT) circuits in the brain. The neuroanatomy of this system is the forehead cortex, amygdala, and basal ganglia. This system is activated by pleasant stimuli associated with reward and lack of punishment (10). The second system is the Behavioral Inhibition System (BIS), which response to conditional punishment and lack of reward and new stimuli and intrinsic frightening stimuli. This activity triggers the emotional state of anxiety and behavioral inhibition, passive avoidance, silence, increased attention, and arousal. The neuropathology basics of the system, which is associated with the experience of anxiety (11), are located in the septo-hippocampal system of the brain, the papillary circuit, and the anterior-cortical cortex (12). The third system is the Fight-Flight System (FFS), structurally related to the amygdala and hypothalamus and is sensitive to irritant stimuli (13).

Kimbrel et al. (14) reported that there is a positive relationship between BIS and social anxiety in a sample of adults. On the other hand, brain imaging studies show that during social fears (e.g., when a person speaks in public), there is an increased cerebral blood flow in areas that are considered the neurological foundations of BIS (14).

Carver and White associate the behavioral inhibition system with anxiety and failure, and the behavioral activation system with hope and comfort. Therefore, different sensitivities of brain-behavioral systems in different people affect their vulnerability to experience different psychological states. Theoretical and research evidence indicates

the relationship between brain-behavioral systems and social anxiety so that high sensitivity of BIS and FFS and low sensitivity of BAS play a role in the development of social anxiety disorder (15).

Moreover, research shows that cognitive emotion regulation ability is another predictor of social anxiety (16). Many researchers believe that social anxiety disorder causes dysregulation or emotion regulation problems (17,18). Regulation of emotional experiences through cognitive elements is an essential aspect of the emotion regulation process. In the psychological literature, this concept is called cognitive emotion regulation. Cognitive emotion regulation strategies refer to the ability to understand emotions, modulate emotional experience, and express emotions (19).

In theoretical literature, cognitive emotion regulation strategy is conceptualized as a concept that includes self-blame, rumination, catastrophizing, other-blame as maladaptive strategies, and acceptance, positive refocusing, refocus on planning, positive reappraisal, and putting into perspective as adaptive strategies.

Recent studies indicate a strong relationship between maladaptive cognitive emotion regulation strategies and emotional problems (20-22). According to Gross's emotion regulation theory (23), cognitive emotion regulation strategies include all conscious and unconscious strategies used to increase, maintain, and decrease emotional, behavioral, and cognitive components of an emotional response. Cognitive emotion regulation training includes reducing and controlling negative emotions and how to use positive emotions (24). Cognitive emotion regulation strategies are a central process for all aspects of human functioning and play a significant role in coping with stressful experiences or experiencing happiness (19).

It seems necessary to pay attention to this problem in Iran due to the specific cultural structures. Also, this problem in young people may continue for years if not identified and diagnosed. Despite having many abilities, these people may lose good opportunities to progress in life and individual and interpersonal growth due to lack of self-confidence, fear of negative evaluation, and avoidance of responsibility in the face of social situations (25).

Social anxiety disorder during the education period may be accompanied by problems such as avoiding classes, fear of speaking in public, and, consequently, academic failure and avoiding responsibility in the face of social situations. Therefore, it seems essential to know the factors that cause the initiation and persistence of this disorder because it is not possible to preserve and treat the disorder without knowing its causes.

A review of internal literature shows that these studies have often investigated the direct relationship between brain-behavioral systems and social anxiety, and the mediating role of effective mechanisms in this relationship has been less studied. This study provides a biology-based framework to understand the cognitive foundations of this disorder. Given the research background, the following hypothetical model was developed to determine whether the model is consistent with the measured model.
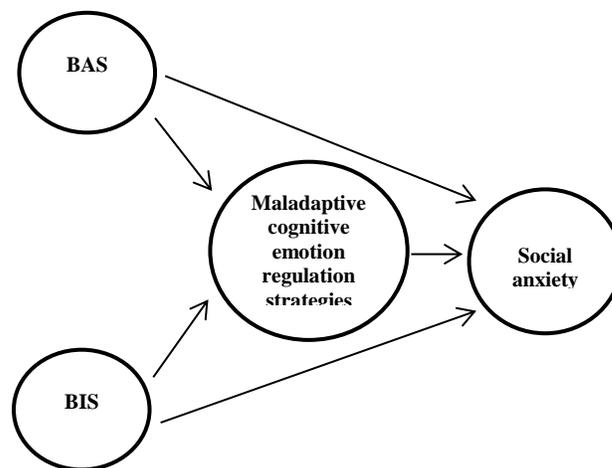

Figure 1. Hypothetical model

This model hypothesizes that BAS and BIS affect social anxiety by mediating cognitive emotion regulation strategies.

Materials and Methods

The statistical population of this descriptive-analytical includes all students of Quchan Azad University in the academic year 2018-2019. Accordingly, the total number of students was 2937. The sample size calculated based on formula and minimum size for structural equation modeling research equal to 200. In this study, the researchers selected 282 students using the multi-stage clustering method from four educational groups of humanities, engineering, basic sciences, and medical sciences. After obtaining the number of students in the university faculties, the number of students required for the sample was calculated based on the relative frequency of students in each faculty. Then, some classes from each faculty were randomly selected, and the questionnaires were distributed among the students. Inclusion criteria included, undergraduate or graduate students, willing to participate in the study, sufficient time to answer the questions, and aged 18-35 years. Exclusion criteria were reluctance to participate in the research and sensory and motor problems. For ethical considerations the researchers used codes in questionnaires to protect personal information, and the participants signed informed consent to participate in the research.

Data analyzed through SPSS software version 23, descriptive statistics and correlation coefficients, and AMOS 24 to investigate the mediating role of the variables.

Research instrument

A) Behavioral Activation and Inhibition Scale (BAS/BIS): This is a 24-item self-report scale which made by Carver and White in 1994. The BIS subscale includes seven items and measures the behavioral inhibition in response to threatening symptoms. On the other hand, the BAS subscale includes 13 items that measure the behavioral activation of system sensitivity. The BAS includes three subscales: drive (4 questions), reward responsiveness (5 questions), and fun seeking (4 questions).

Four additional items are considered as additional items and have no score in BIS/BAS evaluation. The subjects answer the items on a four-point scale. Carver and White (26) reported the reliability of BIS and BAS subscales as 0.74 and 0.71, respectively. Mohammadi (27) has reported that the Persian version of the this scale and indicated its psychometric properties is favorable among Shiraz University students. Test-retest validity for BAS and BIS subscales were reported to be 0.68 and 0.71, respectively (27). Majarshin (28) has reported the questionnaire's test-retest validity as 0.78 and 0.81 for BAS and BIS subscales, respectively.

B) Cognitive Emotion Regulation Questionnaire (CERQ): This is a 36-item self-report questionnaire which made by Garnefski, Kraaij, and Spinhoven in 2002. The questionnaire consists of nine subscales (self-blame, acceptance, rumination, positive refocusing, planning, positive reappraisal, putting into perspective, catastrophizing, and other-blame). The items are scored in range one (rarely) to five (almost always). Each subscale contains four items. The total score of each subscale is calculated as the sum of the scores of items. The total score of each subscale ranges between 4 and 20. The Persian version of the Cognitive Emotion Regulation Questionnaire has been developed. The validity of subscales of this version was reported to be 0.76 to 0.92 based on internal consistency and 0.51 to 0.77 based on test-retest validity. Criterion validity of this version based on its correlation with Beck Depression Inventory-II scores (0.25 to 0.48) and its construct validity based on principal component analysis using Varimax rotation (explaining 74% of the variance) have been reported to be desirable (29).

C) Social Phobia Inventory (SPIN): This is a 17-item self-assessment tool designed to assess anxiety or morbid fear. This inventory has three subscales: fear (6 items), avoidance (7 items), and arousal (4 items). In Iran, Abdi et al. (30) first estimated the content and validity of this

inventory. In their research, its reliability was estimated to be 0.83 by a test-retest method using the Pearson correlation method on a group of students. Moreover, its internal consistency was calculated to be 0.86 using Cronbach's Alpha in patients referred to mental health clinics.

The psychometric properties of this inventory are acceptable. The reliability (correlation coefficient) of this inventory using the test-retest method in those with a social anxiety disorder diagnosis is equal to 0.78 to 0.89, and its internal consistency (Cronbach Alpha) in ordinary people for the whole scale is 0.94. Cut-off point 16

distinguishes individuals with a social anxiety disorder from the control group (individuals without social anxiety) with a diagnostic efficiency of 0.8 (31).

Results

Of 282 participants in the study, 203 (72%) were female, and 79 (28%) were male. The mean age of men and women was in the range of 18-20 years, and most of the participants were single (53.19%) and undergraduate (90%). Table 1 indicates the mean and standard deviation of the variables.

Table 1. Descriptive indicators of research variables

Latent variables		Minimum	Maximum	Mean	Standard deviation
Social anxiety	Fear	0	25	8.07	6.67
	Avoidance	1	25	9.76	4.07
	Physiological discomfort	0	16	6.10	3.05
	Social anxiety	2	60	23.94	9.24
Maladaptive emotion regulation	Self-blame	2	10	5.14	1.94
	Catastrophizing	2	10	4.82	1.94
	Rumination	2	10	6.31	1.90
	Other-blame	2	10	4.27	1.94
BIS		7	25	14.95	3.11
BAS		13	44	22.85	4.54

In the present research, the social anxiety variable is considered a criterion variable, and BAS and BIS variables are considered predictor variables. Moreover, cognitive emotion regulation strategies are considered as mediating variable. The hypothetical structural model was tested using the structural equation modeling method. Amos software uses the Maximum Likelihood estimation technique to estimate the fitness of measurement and structural model. The assumptions of this method are univariate normality and multivariate normality. The usual approach to ensure the univariate normality is to calculate the skewness and elongation of observed variables. The skewness of variables is in the range of 0.08 to 0.98, and their elongation ranges from 0.77 to 1.19. The distribution of scores is expected because skewness and

elongation in all variables are within the range of -2 to +2. Mardia's coefficient was used to estimate multivariate normality. Given that the critical ratio of 0.396 is less than the critical value of 2.58, it can be said that the data distribution is normal.

The results in Table 2 show that the proposed model has a good fit for the data. In the proposed model, the chi-square per degree of freedom was 1.849 (less than 3), which, according to Tabachnick and Fidel (32), shows a good fit of the model. The Goodness of Fit Index (GFI) and Comparative Fit Index (CFI) were 0.95 and 0.94, respectively, more significantly than at 0.90.

The Parsimony Normed Fit Index (PNFI) was 0.63, which is greater than 0.60. The Root Mean Square Error of Approximation (RMSEA) index for the model was 0.057,

less than 0.08 (33). The results show that all indices of the model are in their acceptable range. Accordingly, the final model has a

good fit. Table 2 shows the structural model fit indices.

Table 2. Fitness indices of the conceptual research model

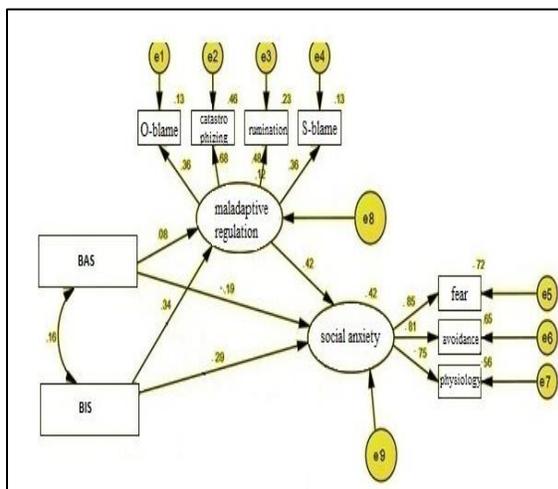| Model	X2/d.f	AGFI	GFI	CFI	PNFI	RMSEA
Acceptable limit	Less than 3	More than 0.8	More than 0.90	More than 0.90	More than 0.60	Less than 0.8
Proposed model	1.849	0.92	0.95	0.94	0.63	0.057

Figure 2. Hypothetical structural model

According to the results provided in Figure 2, the pathway related to the effect of BIS on social anxiety (β=0.29, *P*<0.05) and the pathway related to the effect of BIS on maladaptive cognitive emotion regulation strategies (β=0.34, *P*<0.05) were significant. Moreover, the direct pathway between maladaptive cognitive emotion regulation strategies and social anxiety (β=0.42, *P*<0.05) was significant.

Figure 2 illustrated that the effect of BAS on social anxiety (β=-0.19, *P*<0.05) was negative and significant. However, the effect of BAS on maladaptive cognitive emotion regulation strategies (β=0.08, *P*>0.05) was not significant. We used the Bootstrap method to investigate the mediating role of maladaptive cognitive emotion regulation strategies. Table 3 presented the results of the Bootstrap analysis.
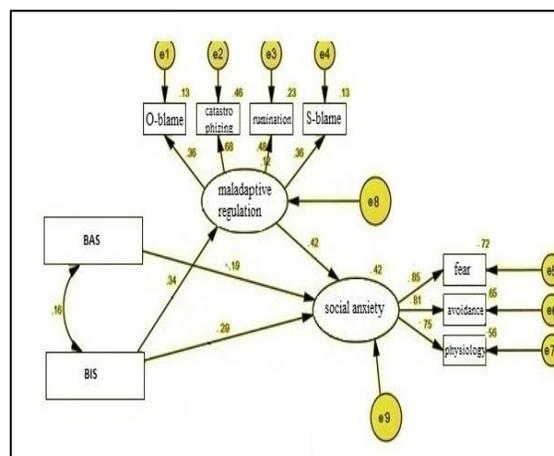

Figure 3. Modified model

Table 3. Standard direct, indirect and total effects of research variables

Variables		Effects				
Predictor	Mediating	Criterion	Direct	P	Indirect	Total
BIS	Maladaptive cognitive emotion regulation strategies	Social anxiety	0.29	0.001	0.14	0.43
BAS	Maladaptive cognitive emotion regulation strategies	Social anxiety	-0.19	0.003	---	---

The findings of Table 3 indicated that the effect of the behavioral inhibition system on social anxiety mediated by maladaptive cognitive emotion regulation strategies was significant. However, the direct effect of

behavioral activation system on social anxiety was significant its indirect effect on social anxiety mediated by maladaptive cognitive emotion regulation strategies was not significant.

Discussion

This study aimed to investigate the effect of brain-behavioral systems on the symptoms of social anxiety disorder by the mediating role of maladaptive cognitive emotion regulation strategies. The results indicated that behavioral inhibition system by mediating role of maladaptive cognitive emotion regulation strategies has significant effect on social anxiety while behavioral activation system has not indirect significant effect on the symptoms of social anxiety.

Some neuropsychological models of emotion and emotional disorders consider a central role for Behavioral Inhibition System (BIS) and Behavioral Activation System (BAS). In this research, BIS has a direct positive effect on social anxiety. The findings are consistent with study by Corinaly (34). The findings showed that BIS is positively associated with interaction anxiety and observation anxiety. Moreover, Kashdan and Roberts (35) showed a positive relationship between BIS and social anxiety. They concluded that social anxiety was the only predictor of negative state affect. The findings indicated that BIS activity evokes an emotional state of anxiety, behavioral inhibition, passive avoidance, silence, increased attention, and arousal. This neuroanatomical basis of system indicates that its high activity is associated with the experience of anxiety (36).

The results of the study showed that there is a relationship between maladaptive cognitive emotion regulation strategies and symptoms of social anxiety. This finding is consistent with the general formulation of cognitive emotion regulation strategies (24,37,38). In this conceptualization, maladaptive cognitive emotion regulation strategies cause the emergence and persistence of various psychopathology forms, but adaptive cognitive emotion regulation strategies act as protective factors. Research conducted shows that adolescents with anxiety disorders think more about the feelings associated with adverse life events and focus more on the negative aspects of their experiences (39). Also, Garnefski et al. (39) found that catastrophizing and rumination are also associated with anxiety symptoms in adolescents and adults in the general community. Expression of emotions is associated with increased positive emotions and psychological adaptation, while repression of emotions is associated with increased negative emotions and psychological dysfunction (24).

Another finding of the study was that BIS has a positive effect on social anxiety symptoms about the mediating role of maladaptive cognitive emotion regulation strategies. Garnefski et al. (39) found that catastrophizing and rumination were positively associated with fear, and thoughts that clearly emphasize the horror of an experience are associated with fear of negative evaluation by others and mindfulness with feelings and thoughts related to the adverse event and increased anxiety. Poor cognitive regulation skills in individuals with social anxiety are documented both at the interpersonal and intrapersonal levels (40). Thus, individuals who have difficulty with cognitive skills catastrophize the threat posed by interpersonal situations and become socially anxious (41). Also, people with high social anxiety have little attention, meaning that instead of focusing on the situation and evaluating how to respond to threats, they focus on threats and create a state of self-centered attention. Therefore, these people are looking for signs of threats in social situations and cannot focus on planning for the desired situation. Thus, maladaptive strategies for harmful and threatening social inputs are proposed as mediators for the relationship between BIS and social anxiety.

Another finding of the study was that the Behavioral Activation System (BAS) hurts the persistence of social anxiety symptoms. This means that the weaker BAS is associated the more social anxiety disorder symptoms. Kimbrel et al. (14) investigated the relationship between the behavioral activation system and interaction anxiety.

Their results showed that BAS is inversely related to interaction anxiety. Also, they showed that people with generalized social fears showed lower levels of BAS sensitivity compared to people with specific social fears. Coplan et al. (45) showed that BAS has a negative relationship with two subscales of social anxiety (fear of negative evaluation and social avoidance). According to Corr (46), BAS and BIS interact to influence behavior. Reward responsiveness is higher among people with high BAS and low BIS sensitivity, while punishment responsiveness is higher among people with high BIS and low BAS sensitivity. Like motivational effects that are interactive, behavioral consequences are affected by both BIS and BAS. Then low BAS sensitivity should facilitate high BIS sensitivity and lead to more anxiety and avoidance in response to threatening social stimulus. Hence, Kimbrel stated that low BAS sensitivity indicates an additional risk factor in social anxiety development (44).

Based on the tested model, the behavioral activation system can directly predict social anxiety, while it cannot explain social anxiety by mediating maladaptive cognitive emotion regulation strategies. As mentioned, researchers have always emphasized the role of biological and cognitive factors in forming social anxiety disorder. In various models proposed to explain this disorder, bio-vulnerability plays a vital role in predisposing a person to the disorder. Moreover, biased cognitive processes have a vital role as the main factor that leads to the disorder's persistence (47).

BAS activity reflects arousal, and the sensitivity to reward directly related to BAS is a sign of arousal. People with anxiety disorder show dysfunction in emotion regulation and use less adaptive coping strategies to repair their mood (48). They also try to avoid situations that provoke intense emotions, which is a maladaptive behavior (49). The behavioral activation system is sensitive to reward signals and engages the person in oriented behaviors.

BAS activity causes impulsive behavior and motivates the person to lead to reward, while the person doesn't realize the possible negative consequences (50). This study was conducted on a non-clinical sample. Therefore, it seems that in healthy individuals, the behavioral activation system cannot explain the variance of social anxiety by mediating cognitive emotion regulation strategies.

This study provides a theoretical framework for the formation and persistence of social anxiety that can help researchers and clinical specialists conceptualize the formation and treatment of this disorder at multiple levels of analysis. This study has limitations in methodology and interpretation, included the participants selected among the student community, ordinary individuals, and bias in research due to the participants' self-reporting. Thus, caution should be exercised in generalizing the study results. It is recommended that this study be conducted on people with other mental disorders, different population groups and age ranges. On the other hand, conducting similar studies by considering the social and family factors in social anxiety disorder can clarify the relationships between research variables.

Conclusion

Based on these findings, it can be concluded that high BIS sensitivity combined with the difficulty in emotion regulation leads to maladaptive efforts to regulate emotional response and, ultimately, increased risk of psychological disorders, including social anxiety.

Acknowledgment

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