



Structural Equation Modeling of Psychosomatic Complaints Based on Perceived Stress, Anxiety Sensitivity, with the Mediating Role of the Active Activation System in Adolescent Girls

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Abstract

Introduction: The current research endeavors to forecast psychosomatic complaints among adolescent female students in Tehran by exploring the interplay between perceived stress and anxiety sensitivity, with a particular focus on the mediating role of behavioral activation systems.

Methods: The method of the present research was correlation. The statistical population included all female adolescents studying during the academic year 2021-2022 in the high schools of Tehran. The sample size consisted of 620 female students selected through multi-stage cluster sampling. Data were collected using the Takata and Sakata (2004) Psychosomatic Complaints Scale, Cohen's Perceived Stress Scale (PSS), Garfield and Marcus (2005) Anxiety Sensitivity Index (ASI), and Carver and White's (1994) Behavioral Activation and Behavioral Inhibition Scales (BAI). Research data were analyzed using SPSS version 25 and PLS version 3.3 software.

Results: The results indicated that the direct effect of perceived stress on behavioral activation ($\beta = -0.22$, $p < 0.05$) and psychosomatic complaints is significant ($\beta = 0.49$, $p < 0.05$). The direct effect of anxiety sensitivity on behavioral activation ($\beta = 0.13$, $p < 0.05$) and psychosomatic complaints ($\beta = 0.34$, $p < 0.05$) is also significant. The direct effect of behavioral activation on psychosomatic complaints is significant ($\beta = 0.08$, $p < 0.05$). The indirect effect of perceived stress through the mediating role of behavioral activation on psychosomatic complaints is significant.

Conclusions: The findings indicate that the proposed model exhibits a strong fit and represents a pivotal advancement in understanding the factors influencing psychosomatic complaints in adolescent girls. In light of these results, it is advisable for clinical psychologists and school counselors to implement targeted interventions focused on reducing anxiety sensitivity and perceived stress. By addressing these factors, practitioners can potentially alleviate psychosomatic issues in adolescent girls, contributing to their overall well-being and mental health.

INTRODUCTION

With the onset of adolescence, girls undergo a series of psychological and physical changes that manifest as sets of behavioral, emotional, and physical transformations. One of the issues adolescents grapple with is paying attention to the signs and psychosomatic complaints [1, 2]. Psychosomatic complaints arise due to stress, psychological pressure, and anxiety, as well as the suppression of psychological pressures, having no

physical origin and causing individuals to perceive their own stresses in the form of physical and bodily pains [3, 4]. Research indicates that most psychosomatic complaints start between the ages of 12 to 24. In general, psychosomatic symptoms tend to increase with age, and women experience these symptoms more frequently than men. Some reports also suggest an increase in psychosomatic complaints among adolescents and

teenagers [5]. The psychosomatic complaints experienced by adolescents can lead to disturbances in cognitive and emotional functioning, impacting their lives [6].

Various psychological factors can be associated with psychosomatic complaints. One significant psychological factor is perceived stress. This concept, derived from Lazarus and Folkman's cognitive appraisal of an individual's evaluation of negative life events, reflects the extent to which individuals perceive stressful events as threatening [7]. Adolescence is a period accompanied by considerable stress. Stress is a serious threat that can lead to mental or physical illness, exerting significant negative effects on the functioning and lifestyles of adolescents [8]. Therefore, it is reasonable to assume that perceived stress plays an influential role in the emergence of psychosomatic problems in adolescents. Another psychological component worth investigating in psychosomatic symptoms is anxiety sensitivity. Individuals with sensitivity to anxiety-inducing cues (e.g., dizziness, increased heart rate, and shortness of breath) fear these physical symptoms associated with anxiety arousal. This fear generally arises from the belief that these symptoms may lead to potentially harmful social, cognitive, and physical consequences [9]. Anxiety sensitivity, through engagement in avoidance and processing information related to anxiety-inducing stimuli, creates a foundation for an individual's susceptibility to psychological disorders, including psychosomatic symptoms, where anxiety is the primary foundation [10]. Since adolescence involves experiencing anxiety-provoking and socially and cognitively threatening conditions, and many adolescents become anxious in response to these threats and pressures, the likelihood of psychosomatic issues arising in them increases [11, 12].

There are also unidentified psychological or neurological mechanisms that create subtle or imperceptible changes in the biochemistry and immune neurophysiology, leading to the onset of these conditions [13]. One of these mechanisms is the concept of the Behavioral Activation System (BAS). According to the theory of traits related to the brain, individuals predispose themselves to psychological disorders and damage. The theory posits two fundamental brain systems that control behavior and emotions [14]. The Behavioral Activation System (BAS), which is triggered by stimuli associated with reward or the cessation of punishment, plays a crucial role by directing the organism toward the associated stimulus. Individuals with heightened sensitivity in the Behavioral Activation System are more inclined to exhibit approach behavior and experience positive emotions in stimulating conditions associated with rewards [15, 16]. Carver and White [17] describe the Behavioral Activation System (BAS) as neurophysiologically reactive and associated with

positive emotions, being activated by positive stimuli. An excessive level of activity in this system has been linked to the development of psychological disorders.

The relationship between perceived stress and anxiety sensitivity with psychosomatic complaints has been corroborated in the studies conducted by Mousavian [18], Rostami [19], and Halsen [20]. Moreover, MoridSaleh [21], Moradi [22], and Chan [23] have confirmed the association between behavioral activation, anxiety sensitivity, and psychosomatic symptoms in their research. Psychosomatic complaints in adolescent girls result in a lack of coherence in psychological, social, emotional, and physical dimensions. The presence of perceived stress and anxiety sensitivity may be related to the occurrence of physical and restraining issues in adolescents with psychosomatic complaints, exacerbating this predicament. Therefore, conducting research in this area is imperative. Research conducted among adolescents has not yet delved into this issue. The subsequent concern is whether, within the framework of a regression model, there has been an examination of psychosomatic complaints based on perceived stress, anxiety sensitivity, and behavioral activation systems. Hence, there is a need to investigate the role of a mediating variable in the relationship between perceived stress, anxiety sensitivity, and psychosomatic complaints. Therefore, the current study aims to determine whether perceived stress, anxiety sensitivity, and with the mediating role of behavioral activation systems, can predict psychosomatic complaints in adolescent girls?

METHODS

The current research study was designed with an applied methodology and Employing a structural equation design correlation. The statistical population consisted of all female adolescents (16 to 18 years old) enrolled in the academic year 2021-2022 in the secondary schools of Tehran. The sample size comprised 620 female students selected through multi-stage cluster sampling. Although there is no general agreement about the required sample size for structural models and path analysis, a minimum sample size of 300 samples has been recommended to a large number of researchers. In general, in the methodology of structural equation modeling and path analysis for determining the sample size, between 5 and 15 observations can be determined from each measurement change (24). For this purpose, taking into account the number of items in the questionnaires used in the current research (84 items) and the standard of 5 people for each item, and taking into account the possibility of sample dropout, the sample size is 700 people.

For the implementation of the research, after obtaining ethical code, a formal introduction letter was obtained

from the University for conducting research in the education department. Following the approval from the Tehran Department of Education, initially, three regions of Tehran (districts 5, 11, 13) were randomly selected. Then, in the second stage, two schools were randomly selected from each of the chosen regions. In the third stage, four classes were randomly selected from the chosen schools, comprising 700 students who answered the questionnaire items. However, due to sample refinement, the research sample included 620 students. The researcher, in cooperation with the school principals, obtained the consent of the parents of the students of the selected classes to participate in the research and gave them the contact number to communicate and answer any questions and ambiguities. To conduct the research, the survey link was placed in classroom groups (using the Shad program) or in the school premises for students to respond. Necessary instructions for completing the items were provided by the researcher and the school staff to the students. Motivational measures, such as providing online questionnaire completion incentives like mobile phone credits, were also considered for the students. It is worth mentioning that female students were selected through multi-stage cluster sampling, and the criteria for sample selection included being female, aged between 16 and 18 years old, willingness to cooperate and complete the items, living with parents during the research period, parental consent for their child's participation in the research, non-participation in counseling and psychological therapy sessions during the research period, no history of psychiatric treatment, and not consuming psychiatric medications during the research period. The criterion for withdrawal from the study was not responding to 20% of the research questions (25). In this study, the Helsinki Declaration principles (26), were considered.

Research Instrument

Psychosomatic Complaints Scale: The present study employed the psychological complaints scale developed by Takata and Sakata [24] in Japan. This scale comprises 30 questions and follows a single-factor structure. The questionnaire is scored on a 4-point Likert scale, with scores of 0, 1, 2, and 3 assigned to the options "Never," "Rarely," "Sometimes," and "Frequently," respectively. The score range for this scale is 0 to 90. A score between 0 and 30 indicates weak psychological complaints, 31 to 60 suggests moderate psychological complaints, and 61 to 90 signifies strong or severe psychological complaints. The creators of this scale established its concurrent validity by calculating its correlation with the General Mental Health Scale in two separate studies, obtaining coefficients of 0.64 and 0.65. Additionally, they utilized factor analysis to assess the structural validity of the scale in two studies, revealing that 34.1% and 31.1% of the variances in the factors were

explained by a single factor in the first study conducted in 1997 and the second study in 1999, respectively. The reliability of this scale, measured using Cronbach's alpha, was 0.93 in 1997 and 0.92 in 1999 [24]. In the study conducted by Hajlou, to examine the concurrent validity of the mental complaints scale, its correlation with the general health scale was calculated. The correlation coefficient between these two scales among students was found to be 0.68. The test-retest reliability of the mental complaints scale, performed at one-month intervals on a sample of 30 students, was confirmed ($r = 0.83$). The Cronbach's alpha coefficient obtained on the original sample was also 0.85, indicating high internal consistency for the components of this scale [25]. Similarly, in the present study, the reliability of the questionnaire was established with a Cronbach's alpha coefficient of 0.89.

Perceived Stress Scale (PSS): The questionnaire was developed by Cohen and colleagues in 1983, consisting of 14 items. The scoring is based on a 5-point Likert scale, with responses ranging from "Never" (0) to "Almost Always" (4). The items 4, 5, 6, 7, 9, 10, and 13 are reverse-scored, encompassing scores from "Never" (4) to "Almost Always" (0). The minimum score attainable is zero, and the maximum score is 56. A cutoff score of 21 indicates higher perceived stress. The reliability coefficients, as measured by Cronbach's alpha, ranged from 84% to 86% in two groups of students and one group of smokers in a cessation program. The Perceived Stress Scale (PSS) demonstrated significant associations with life events, depressive and physical symptoms, utilization of health services, anxiety, and low life satisfaction [26]. In Ghorbani, Davison [27]'s study, Cronbach's alpha for the PSS was calculated as 0.81. The content validity of these questionnaires was confirmed by ten faculty members from Mashhad University of Medical Sciences. The Persian version's internal consistency, calculated using Cronbach's alpha, was 0.74 [28]. In the current study, the reliability of the questionnaire was confirmed using Cronbach's alpha, resulting in a coefficient of 0.83.

Anxiety Sensitivity Index (ASI): The Anxiety Sensitivity Questionnaire is a self-report instrument comprising 16 items. It employs a 5-point Likert scale ranging from "Not at all" (0) to "Very much" (4). Each item reflects the belief that anxiety-related sensations are experienced unpleasantly and have the potential for harmful consequences. Higher scores indicate a greater experience of fear of anxiety symptoms. The score range is from 0 to 64. Floyd, Garfield [29] proposed a three-factor structure for this questionnaire, encompassing fear of physical concerns (8 items), fear of cognitive dyscontrol (4 items), and fear of observable anxiety by others (4 items). Psychometric properties assessment revealed internal consistency stability (alpha between 0.80 and 0.90). Test-retest reliability after 2 weeks was 0.75, and over a three-year period, it was 0.71,

demonstrating the stability of anxiety sensitivity as a personality construct. The Iranian sample showed high internal consistency ($\alpha = 0.93, 0.95, 0.97$) across three methods: internal consistency, test-retest, and parallel forms. Concurrent validity was established through simultaneous administration with the SCL-90 questionnaire, yielding a correlation coefficient of 0.56. Correlation coefficients with the total score ranged from 0.74 to 0.88, indicating satisfactory convergent validity. Shakerinia [30] reported a reliability coefficient of 0.90 using Cronbach's alpha and a validity coefficient of 0.64 with the Psychometric Rigidity Scale in Ahvaz. In the present study, the questionnaire's reliability was confirmed with a Cronbach's alpha coefficient of 0.89.

Behavioral Activation and Behavioral Inhibition Scales (BAI): Behavioral Activation and Behavioral Inhibition Scales (BAI) [17] consists of 24 self-report items and two subscales: The Behavioral Inhibition System (BIS) and the Behavioral Activation System (BAS). In this study, the Behavioral Activation System subscale with 13 items was utilized. Carver and White [17] reported the reliability of the mentioned questionnaire using Cronbach's alpha as 0.77 for the Behavioral Inhibition System and 0.78 for the Behavioral Activation System. Abdollahi Majaresheem [31] calculated the reliability of the questionnaire through test-retest method for BIS and BAS systems as 0.78 and 0.81, respectively. In the current research, the coefficient of reliability for the Behavioral Activation System subscale was determined as 0.78 using Cronbach's alpha.

Statistical Analyses

Data analysis in this research involved both descriptive and inferential statistics. Descriptive analyses utilized frequency, percentage, median, mean, and standard deviation. Prior to investigating the research hypotheses, the assumption of normality was assessed using the Kolmogorov-Smirnov test. Subsequently, the research model underwent examination through structural equation modeling. Descriptive data analyses were performed using SPSS-25 software. Due to the non-normality observed in some variables of our research data, we opted for version 3.3 of PLS (Partial Least Squares) for modeling and fitting. This software operates on a partial least squares approach, rendering it insensitive to the non-normality of sampling distribution and sample size [32]. All inferential analyses were conducted at a significance level of 0.05.

Results

A total of 620 adolescent girls were included in the study, among whom 98 participants (15.81%) were 18 years old, 240 participants (38.71%) were 17 years old, and 282 participants (45.48%) were 16 years old. In terms of academic performance, 13 participants (2.10%) had a Grade Point Average (GPA) below 12, 81 participants (13.065%) had a GPA between 12 and

14, 188 participants (30.33%) had a GPA between 15 and 16, 249 participants (40.16%) had a GPA between 17 and 18, 89 participants (14.36%) had a GPA between 19 and 20.

Before examining the conceptual model, the normality of the research variables and the assumption of linearity were assessed using the Kolmogorov-Smirnov test. The results of the Kolmogorov-Smirnov test indicate that the variables of mental health problems ($Z = 0.96, P < 0.05$), perceived stress ($Z = 0.99, P < 0.05$), anxiety sensitivity ($Z = 0.93, P < 0.05$), and behavioral activation ($Z = 0.97, P < 0.05$) do not follow a normal distribution. The examination of the non-linearity assumption suggests that perceived stress variables (tolerance = 1, eigenvalue = 0.15, condition index = 3.51), anxiety sensitivity (tolerance = 1, eigenvalue = 0.007, condition index = 16.51), and behavioral activation (tolerance = 1, eigenvalue = 0.039, condition index = 7.09) do not have a linear relationship.

The correlation between research variables was examined using the Spearman correlation coefficient due to the non-normality of the data. The results of the Spearman correlation coefficient in Table 1 indicate a positive and significant correlation between anxiety sensitivity and perceived stress with psychosocial problems.

To evaluate the goodness of fit of the model, indicators such as Standardized Root Mean Squared Error (SRMR), Normed Fit Index (NFI), and Goodness of Fit (GoF) were employed. A model is considered to have a good fit if the SRMR is less than 0.08, NFI exceeds 0.90, and GoF surpasses 0.30. In this study, the SRMR and NFI values were 0.08 and 0.90, respectively, indicating an acceptable fit. Given that both the SRMR is equal to or less than 0.08 and the NFI is equal to or greater than 0.90, the model fit is deemed acceptable.

This index indicates the fit between the quality of the structural model and the measured model (reflecting the overall model fit). It is the primary fit index in PLS and is denoted by:

$$GOF = \sqrt{COMMUNITY} \times \sqrt{R^2}$$

An elevation of the fit index above 30/0 indicates a desirable model fit. In the current study, the value of this fit index is 36/0, surpassing the threshold of 30/0, suggesting a suitable fit for the model.

The results of the beta coefficients and bootstrapping (T) related to the direct and indirect effects of psychological complaints on perceived stress and anxiety sensitivity in adolescent girls are presented in Table 2 on perceived stress and anxiety sensitivity in adolescent girls are presented in Table 2.

The results in Table 2 indicate that the direct effect of perceived stress on behavioral activation and psychological complaints is significant. The direct effect of anxiety sensitivity on behavioral activation is

significant. The direct effect of behavioral activation on psychological complaints is significant. The indirect effect of perceived stress, mediated by behavioral

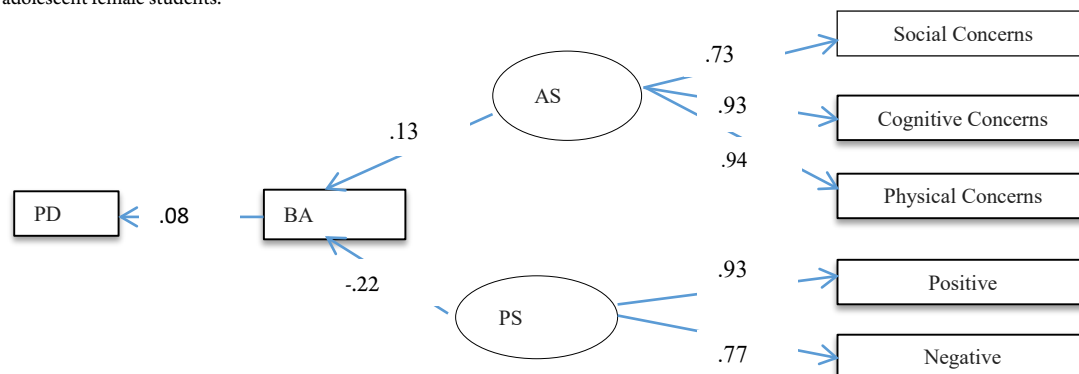
activation, on psychological complaints is also significant.

Table 1. Spearman's correlation matrix between research variables

Variable	Mean $\pm$ SD	1	2	3	4
1. Anxiety sensitivity	36.25 $\pm$ 9.51	1	-	-	-
2. Perceived stress	18.31 $\pm$ 11.36	0.36**	1	-	-
3. Behavioral activation	44.26 $\pm$ 5.25	0.058	-0.10**	1	-
4. Psychosomatic problems	26.52 $\pm$ 15.43	0.53**	0.61**	-0.05	1

N=620, *P < 0.05, **P < 0.01

Figure 1. The fitted model of psychosomatic complaints based on perceived stress, anxiety sensitivity with the mediation of the activation system in adolescent female students.



Note: PD=Psychosomatic symptoms, BA=Behavioral Activation, AS= Anxiety Sensitivity, PS= Perceived Stress

Table 2. Beta and bootstrap (T) coefficients related to the direct and indirect effects of psychosomatic complaints based on perceived stress and anxiety sensitivity in adolescent girls.

Direct and Indirect Effects	Beta	T	Significance level
Direct Effects			
Perceived stress $\rightarrow$ behavioral activation	-0.218	4.528	0.0001
Perceived stress $\rightarrow$ psychosomatic complaints	0.49	15.506	0.0001
Anxiety sensitivity $\rightarrow$ behavioral activation	0.133	2.745	0.006
Anxiety sensitivity $\rightarrow$ Psychosomatic complaints	0.345	10.638	0.0001
Behavioral activation $\rightarrow$ Psychosomatic complaints	-0.083	2.347	0.019
Indirect Effects			
Perceived stress $\rightarrow$ behavioral activation $\rightarrow$ psychosomatic complaints	0.018	2.104	0.036
Anxiety sensitivity $\rightarrow$ behavioral activation $\rightarrow$ psychosomatic complaints	-0.011	1.767	0.078

DISCUSSION

The current research aimed to predict psychosomatic Complaints based on perceived stress and anxiety sensitivity with the mediating role of behavioral activation in adolescent female students in Tehran. The results indicated that the direct effect of perceived stress on behavioral activation and psychological complaints is significant. The direct effect of anxiety sensitivity on behavioral activation and psychosomatic complaints is also significant. Additionally, the direct effect of behavioral activation on psychosomatic complaints is significant. The indirect effect of perceived stress, mediated by behavioral activation, on psychosomatic complaints is also found to be significant. This result aligns with previous studies by Mousavian [18], Rostami [19], MoridSaleh [21], Moradi [22], Halsen [20], and Chan [23].

Perceived stress can have adverse effects on the autonomic nervous system, which plays a crucial role in

controlling bodily functions, including heart rate, blood vessels, digestive system, and respiration. Chronic stress can lead to dysfunctions in this system, triggering psychosomatic symptoms such as abdominal pain, headaches, digestive issues, and cardiac symptoms. Perceived stress can negatively impact the immune system. Prolonged stress may result in decreased immune function, making the individual more susceptible to infections and diseases. This could manifest in psychosomatic symptoms like fatigue, recurrent colds, muscle pain, and inflammatory symptoms. Perceived stress can stimulate inflammatory processes in the body. Chronic stress might lead to an increase in inflammatory hormone levels, such as stress and cortisol responses. These processes can contribute to psychosomatic symptoms such as joint pain, skin inflammation, and other inflammatory manifestations. Perceived stress can have psychological effects on the body. Negative moods, anxiety, and depression, often associated with stress, can contribute to psychosomatic

symptoms such as body pain, muscle tension, and sleep problems [23, 33-36].

In explaining the relationship between anxiety sensitivity and psychosomatic problems, it can be stated that individuals with high levels of anxiety sensitivity tend to perceive stressful situations excessively through their emotions and thoughts. In a heightened state of readiness, they confront stressful situations with intense anxiety responses. Individuals with high anxiety sensitivity often react negatively to anxiety symptoms, while those with low anxiety sensitivity may perceive the symptoms as unpleasant but not threatening [10].

Anxiety sensitivity refers to an individual's propensity to experience anxiety in response to various situations and events. This heightened sensitivity may indicate an increased level of reactivity and response to stressors and threats. Response to Threats: Individuals with anxiety sensitivity may respond to situations that are not generally perceived as threatening with anxious reactions and heightened activation. They may quickly and intensely react to threats and stressors, engaging in preparedness behaviors and adopting cautious behaviors. Individuals with anxiety sensitivity may pay more attention to physical and psychological symptoms of stress. They may exhibit stronger reactions to symptoms such as worry, fear, muscle tension, and physiological changes. This heightened attention to symptoms may lead these individuals to exert more effort in controlling stressors and improving their condition. Individuals with anxiety sensitivity may exhibit intense activation responses when facing stressors and threats. This includes increased heart rate, rapid breathing, elevated secretion of stress hormones like adrenaline, and increased bodily readiness to cope with threats. These heightened activation responses may be more pronounced in individuals with anxiety sensitivity [37, 38].

The activation involving perceived stress, anxiety sensitivity, and psychosomatic conditions serves as a mediator, as anxiety sensitivity and perceived stress can impact the regulation and functioning of the autonomic nervous system (ANS). The ANS, composed of the sympathetic and parasympathetic nervous systems, plays a crucial role in regulating involuntary bodily activities such as heart rate, respiration, digestion, and more. When an individual with anxiety sensitivity faces stressful situations and threats, the sympathetic nervous system becomes activated, initiating the physiological stress response. This response includes increased heart rate, rapid breathing, secretion of stress hormones like adrenaline, and heightened bodily readiness to cope with threats. Repetitive and prolonged activation of the sympathetic nervous system as a response to anxiety

sensitivity may indirectly lead to detrimental psychological and physiological effects in the body. Some of these effects may manifest as psychosomatic problems, representing physical issues directly resulting from stress and anxiety. Examples of psychosomatic problems include headaches, muscle pain, gastrointestinal issues, sleep disturbances, menstrual disorders, and more. Therefore, the activation between anxiety sensitivity, perceived stress, and psychosomatic problems implies that anxiety sensitivity can trigger the activation of the sympathetic nervous system, and this activation may indirectly lead to psychosomatic issues in the body [39, 40].

CONCLUSION

The findings of the current research highlight that perceived stress and anxiety sensitivity serve as significant predictors of both behavioral activation and psychosomatic complaints. Moreover, behavioral activation was identified as a predictor of psychosomatic complaints. The findings suggest that the proposed model demonstrated a good fit and can be a crucial step in identifying factors influencing psychosomatic complaints in adolescent girls. Based on these results, clinical psychologists and school counselors are recommended to provide interventions aimed at reducing anxiety sensitivity and perceived stress, consequently alleviating psychosomatic problems in adolescent girls.

Limitation

Some limitations are associated with online data collection, where participants' self-reporting in an online survey may introduce errors in the data reporting. Another limitation is that the present study focused on predicting psychosomatic complaints based on perceived stress, anxiety sensitivity, with the mediation of behavioral activation in adolescent girls. Therefore, generalizing the results to other groups and populations may be limited.

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AUTHOR'S CONTRIBUTIONS

Mahnaz Afrasiabi: Study concept and design, acquisition of data, analysis and interpretation of data, and statistical analysis. Farhad Jomehri: Administrative, technical, and material support, study supervision. Lida Leilabadi: Critical revision of the manuscript for important intellectual content.

ETHICAL CONSIDERATIONS

The study was approved by the Ethical Committee of Islamic Azad University Central Tehran Branch [IR.IAU.CTB.1401.144].

CONFLICT OF INTEREST

There are no conflicts of interest regarding the publication of the current research.

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REFERENCES

- Habermann K, Napp A-K, Reiß F, Kaman A, Erhart M, Ravens-Sieberer U. Psychosomatic health complaints among children and adolescents during the COVID-19 pandemic—Results of the longitudinal German COPSy study. 2024. [doi: 10.21203/rs.3.rs-3931638/v1](#)
- Laftman SB, Ostberg V, Raninen J. Trust and Psychosomatic Complaints in Adolescence: Findings From a Swedish Cohort Study. *Int J Public Health*. 2023;68:1606032. [doi: 10.3389/ijph.2023.1606032](#) [pmid: 37885767](#)
- Fretz BR, Kluge NA, Ossana SM, Jones SM, Merikangas MW. Intervention targets for reducing preretirement anxiety and depression. *Journal of Counseling Psychology*. 1989;36(3):301-7. [doi: 10.1037/0022-0167.36.3.301](#)
- Fernandez MDM, Montes-Martinez A, Pineiro-Lamas M, Regueira-Mendez C, Takkouche B. Tobacco consumption and premenstrual syndrome: A case-control study. *PLoS One*. 2019;14(6):e0218794. [doi: 10.1371/journal.pone.0218794](#) [pmid: 31226148](#)
- Hogberg B, Strandh M, Johansson K, Petersen S. Trends in adolescent psychosomatic complaints: a quantile regression analysis of Swedish HBSC data 1985-2017. *Scand J Public Health*. 2023;51(4):619-27. [doi: 10.1177/14034948221094497](#) [pmid: 35531772](#)
- Delveci A, Jeferson, Q., Chilawer, J. & Shes, A. . The effect of effectiveness of cognitive-behavioral therapy on the cognitive emotion regulation of girls ac psychosomatic complaints syndrome. *Behavior Therapy*. 2022;57, 167-183.
- Nakamura N, Tsong Y. Perceived stress, psychological functioning, and resilience among individuals in same-sex binational relationships. *Psychology of Sexual Orientation and Gender Diversity*. 2019;6(2):175-81. [doi: 10.1037/sgd0000318](#)
- Sing Chai M. Personality, Coping and Stress Among University Students. *American Journal of Applied Psychology*. 2015;4(3):33-8. [doi: 10.11648/j.ajap.s.2015040301.16](#)
- Zinbarg RE, Mohlman J, Hong NN. Dimensions of anxiety sensitivity. *Anxiety sensitivity*: Routledge; 2014. p. 83-114.
- Smits JAJ, Otto MW, Powers MB, Baird SO. Anxiety sensitivity as a transdiagnostic treatment target. *The Clinician's Guide to Anxiety Sensitivity Treatment and Assessment*: Elsevier; 2019. p. 1-8.
- Ahmadi R, Saed O, Rezaei M, Ahmadi Zadeh R. Anxiety Sensitivity as a Transdiagnostic Construct in Development and Maintenance of Emotional Disorders: A Literature Review. *Scientific Journal of Kurdistan University of Medical Sciences*. 2020;25(3):44-60. [doi: 10.52547/sjku.25.3.44](#)
- Fitzgerald HE, Hoyt DL, Kredlow MA, Smits JA, Schmidt NB, Edmondson D, et al. Anxiety sensitivity as a malleable mechanistic target for prevention interventions: A meta-analysis of the efficacy of brief treatment interventions. *Clinical Psychology: Science and Practice*. 2021;28(4):323. [doi: 35300171](#)
- Erfan M, Roustaei M, Maboudinejad S, Pourakbaran E, Badihi Zeraati F. Relationship between the Activity of Behavioral Activation Systems (BAS) and Behavioral Inhibition (BIS) and Health Anxiety with the Mediating Role of Adaptive Cognitive Emotion Regulation Strategies. *Journal of North Khorasan University of Medical Sciences*. 2022;14(1):61-9. [doi: 10.52547/nkums.14.1.61](#)
- Gray JA. Brain Systems that Mediate both Emotion and Cognition. *Cognition & Emotion*. 1990;4(3):269-88. [doi: 10.1080/02699939008410799](#)
- Kelley NJ, Kramer AM, Young KS, Echiverri-Cohen AM, Chat IK, Bookheimer SY, et al. Evidence for a general factor of behavioral activation system sensitivity. *J Res Pers*. 2019;79:30-9. [doi: 10.1016/j.jrp.2019.01.002](#) [pmid: 30853731](#)
- Leung YK, Franken IHA, Thurik AR. Psychiatric symptoms and entrepreneurial intention: The role of the behavioral activation system. *Journal of Business Venturing Insights*. 2020;13:e00153. [doi: 10.1016/j.jbvi.2019.e00153](#)
- Carver CS, White TL. Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS Scales. *Journal of Personality and Social Psychology*. 1994;67(2):319-33. [doi: 10.1037/0022-3514.67.2.319](#)
- Mousavian R. Predicting psychological complaints in M.S. patients based on anxiety sensitivity and perceived stress. Master's thesis, Islamic Azad University, Ahvaz. 2022.
- Rostami B. Predicting psychological complaints based on anxiety and emotional inhibition in diabetic patients. Master's thesis, Islamic Azad University, Tehran. 2021.
- Halsen A, Gros, F. and Gerinson, H. The model predicting psychosomatic complaints based on anxiety sensitivity, obsessive rumination and perceived stress. *Journal of Health*. 2022;23: 113-124.
- MoridSaleh M. Predictive model of illness complaints based on behavioral activation-inhibition system and depression in patients. Master's thesis, Islamic Azad University, Ahvaz. 2022.
- Moradi E, & Niazi, S. The relationship between behavioral activation-inhibition system and psychological problems. *Social Cognition*. 2021;6(12), 168-180.
- Chan H, & Danson, S. The relationship between behavioral activation-inhibition system with anxiety sensitivity and stress and depression in diabetes. *Journal of Clinical Psychology and Psychotherapy*. 2022;12,55-76.
- Takata Y, Sakata Y. Development of a psychosomatic complaints scale for adolescents. *Psychiatry Clin Neurosci*. 2004;58(1):3-7. [doi: 10.1111/j.1440-1819.2004.01184.x](#) [pmid: 14678449](#)
- Hajlou N. Psychological characteristics of the TAKATA and SAKATA Psychological Complaints Scale among students of Mohaghegh Ardabili University. *Behavioral Sciences Research*. 2012;10(3), 204-212.
- Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav*. 1983;24(4):385-96. [pmid: 6668417](#)
- Ghorbani N, Davison HK, Bing MN, Watson PJ, Mack DA. Self-reported emotional intelligence: Construct similarity and functional dissimilarity of higher-order processing in Iran and the United States. *International Journal of Psychology*. 2010;37(5):297-308. [doi: 10.1080/00207590244000098](#)
- Bastani F, RAHMATNEZHAD L, Jahdi F, Haghani H. Breastfeeding self efficacy and perceived stress in primiparous mothers. 2008.
- Floyd M, Garfield A, LaSota MT. Anxiety sensitivity and worry. *Personality and Individual Differences*. 2005;38(5):1223-9. [doi: 10.1016/j.paid.2004.08.005](#)
- Shakerinia E. The relationship between social support and hope to men with chronic pain and physical health in older adults. *Salmand: Iranian Journal of Ageing*. 2012;7(24):7-15.
- Abdollahi Majaresheer R, Bakhshipour, A., & Mahmoudaliloo, M. Reliability and validity of behavioral inhibition and activation systems (BIS/BAS) in the student population of Tabriz University. *Journal of Modern Psychological Research*. 2012;7(28), 123-139.
- Hair JF, Risher JJ, Sarstedt M, Ringle CM. When to use and how to report the results of PLS-SEM. *European Business Review*. 2019;31(1):2-24. [doi: 10.1108/ebur-11-2018-0203](#)

33. Barsky AJ, Orav EJ, Bates DW. Somatization increases medical utilization and costs independent of psychiatric and medical comorbidity. *Arch Gen Psychiatry*. 2005;62(8):903-10. [doi: 10.1001/archpsyc.62.8.903](#) [pmid: 16061768](#)
34. Cohen S, Janicki-Deverts D, Miller GE. Psychological stress and disease. *JAMA*. 2007;298(14):1685-7. [doi: 10.1001/jama.298.14.1685](#) [pmid: 17925521](#)
35. McEwen BS. Central effects of stress hormones in health and disease: Understanding the protective and damaging effects of stress and stress mediators. *Eur J Pharmacol*. 2008;583(2-3):174-85. [doi: 10.1016/j.ejphar.2007.11.071](#) [pmid: 18282566](#)
36. Segerstrom SC, Miller GE. Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry. *Psychol Bull*. 2004;130(4):601-30. [doi: 10.1037/0033-2909.130.4.601](#) [pmid: 15250815](#)
37. Gomez GJ, Burr EK, DiBello AM, Farris SG. Understanding sex differences in physical activity behavior: The role of anxiety sensitivity. *Mental Health and Physical Activity*. 2021;20:100392. [doi: 10.1016/j.mhpa.2021.100392](#)
38. Taylor S. Anxiety sensitivity: theoretical perspectives and recent findings. *Behav Res Ther*. 1995;33(3):243-58. [doi: 10.1016/0005-7967\(94\)00063-p](#) [pmid: 7726801](#)
39. Levenstein S, Prantera C, Varvo V, Scribano ML, Berto E, Luzzi C, et al. Development of the Perceived Stress Questionnaire: a new tool for psychosomatic research. *J Psychosom Res*. 1993;37(1):19-32. [doi: 10.1016/0022-3999\(93\)90120-5](#) [pmid: 8421257](#)
40. Zvolensky MJ, Shepherd JM, Clausen BK, Kauffman BY, Heggeness L, Garey L. Anxiety Sensitivity Among Non-Hispanic Black Adults: Relations to Mental Health and Psychosomatic States. *J Racial Ethn Health Disparities*. 2023;10(2):751-60. [doi: 10.1007/s40615-022-01263-0](#) [pmid: 35182371](#)