



Original Article

Relationship between fear of coronavirus and death anxiety: Mediating role of behavioral inhibition system

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Abstract

Introduction: Due to the increasing rate of coronavirus disease, the experience of high levels of fear and anxiety worldwide is predictable. In this regard, the results of previous studies have shown that each of the variables of fear of coronavirus and behavioral inhibition system plays a decisive role in predicting death anxiety. Therefore this study aimed to investigate the relationship between fear of coronavirus and death anxiety, and the mediating role of behavioral inhibition system in this regard.

Materials and Methods: The research method of this study was descriptive-correlation type and structural equations. The statistical population of this study included Iranian adults. Among them 605 people were selected by the available sampling method. Data were collected in July and August 2020 using the Templer death anxiety scale, fear of COVID-19 Scale, and the Carver and White BIS/BAS Scale in Mashhad, Iran. Data analysis was performed using the Pearson correlation method and path analysis.

Results: The results showed that death anxiety was significantly associated with fear of coronavirus ($P < 0.01$) and the behavioral inhibition system ($P < 0.01$). Also, the mediating role of the behavioral inhibition system was confirmed at the level of 0.001.

Conclusion: According to the findings of this study, fear of coronavirus can predict death anxiety through the mediating role of the behavioral inhibition system.

Keywords: Behavioral inhibition system, Death anxiety, Fear of coronavirus

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Introduction

In late December 2019, a group of patients with an initial diagnosis of pneumonia was admitted to hospitals for unknown reasons. The

common denominator of all these patients was their visit to a seafood wholesale market in Wuhan, China. Experiments revealed that they were infected with coronavirus. Coronavirus is

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one of the most important pathogens that primarily targets the human respiratory system (1,2). On March 11, 2020, following the spread of the virus, the World Health Organization declared the disease a pandemic (3,4).

Due to the high increase in the prevalence of this disease and the lack of appropriate and definitive treatment for it, the experience of high levels of fear and anxiety around the world can be predicted (4-7). Studies on previous epidemics such as Ebola, SARS, Avian flu, etc. It has been well shown that anxiety, health concerns, and safety behaviors are very widespread in this period (8,9). Recently, research has begun to examine fear, anxiety, and other emotional symptoms during the coronavirus epidemic (10,11); More than 50% of people report experiencing fear, worry, and anxiety due to pandemic diseases (9,12). In China, after the coronavirus outbreak, approximately 25% to 35% of people reported suffering from symptoms of anxiety and stress (13,14).

Anxiety is a primitive emotion that acts to maintain the survival of human life and protect him from any danger, which helps maintain the security and well-being of human beings (15). However, with the spread of coronavirus, some factors such as fear of contracting it, spreading false news and rumors, fear of death, prohibition or restriction of traffic, interference in daily activities, financial and occupational problems, Decreased social interactions (colleagues, friends, family), and dozens of other factors associated with these conditions, endangered the mental health of individuals in the community; According to the available research evidence, one of the psychological effects of this disease is death anxiety (7,11,16-18). Death anxiety is one of the types of anxiety that has been discussed mainly by philosophers and existential psychologists (19). They have argued that this type of anxiety is experienced in the depths of one's being and is not so much related to the conscious level of the individual's personality (19) but is a conscious or unconscious state of mind that arises as a result of a defense mechanism. It can be stimulated by death and endangering survival (20). The North American Nursing Diagnosis Association also defines this type of anxiety as a feeling of insecurity, anxiety, or fear related to the experience of death or near-death experience (21). The coronavirus epidemic posed unique challenges to humans due to the constant

reminder of death. Newton et al. have demonstrated the omnipresent images of human death: the constant transmission of the epidemics, suicide, and the mask on faces. This means that we are in a prominent period of globalized death anxiety (22). The results of Menzies et al.'s research also indicate that the actual increase in mortality rates worldwide and the numerous financial, social, and personal losses have increased death anxiety among humans (23). In the study of Lazaro Perez et al. and Lee et al., the results showed that the coronavirus epidemic and the inability of humans to cope with this disease caused them to experience high levels of death anxiety (11,24).

On the other hand, previous studies have shown a relationship between this type of anxiety and behavioral inhibition and behavioral activation systems (25,26). There are two basic brain systems called the behavioral inhibition system and the behavioral activation system, which control behavior and emotion (27-29). The behavioral inhibition system responds to stimuli related to punishment or deprivation of reward and leads to behavioral withdrawal or arousal; the Behavioral activation system also responds to stimuli related to reward or avoidance of punishment and leads to behavior and arousal (30). When assessing risk, the behavioral inhibition system creates and maintains the motivation of individuals to deal with that risk (31). However, very high sensitivity in this system will lead to widespread adverse effects, especially anxiety and anxiety disorders (32,33). In this regard, Kazerooni and Akrami's research showed that the behavioral inhibition system is the best predictor of death anxiety (34). Therefore, as the results of previous studies show, each of the variables of fear of coronavirus and behavioral inhibition system plays a decisive role in predicting death anxiety. However, according to the present study, the mediating role of the behavioral inhibition system between coronavirus fear and death anxiety has not been studied in domestic and foreign studies. Therefore, the present study seeks to determine whether the behavioral inhibition system can mediate the relationship between coronavirus fear and death anxiety. The results of this study can be effective in better understanding the psychological effects of the coronavirus epidemic and improving mental health.

Materials and Methods

This study with the ethics code IR.UM.REC.1399.142 was approved by the ethics committee of Ferdowsi University of Mashhad. Whereas the present study sought to predict death anxiety based on the behavioral inhibition system and fear of coronavirus.

The general design of the present study was descriptive correlational method and path analysis. The statistical population of this study included all adults living in Mashhad who had good access to the Internet and cyberspace at the time of sampling. Among them, based on the type of statistical method used and calculating 25% of sample fall and effect size of 0.12 through G-power software, the minimum sample size was determined to be 300 people; However, to increase the similarity of the present sample with the target population, improve the test power and increase the generalizability of the results, 605 people were selected as the sample by the available method. Also, because the study was conducted at the time of the coronavirus outbreak and lack of face-to-face access to individuals; Sampling was done through an online questionnaire.

Research instruments

A) Demographic Checklist: In this section of individuals, personal information including gender, age, level of education, marital status, history of physical and psychological problems, and ways to reconnect to receive research findings were received.

B) Templer Death Anxiety Scale: This questionnaire consisted of 15 items and was developed in 1970 by Templer to measure death anxiety. Subjects mark their answers to each item with a "yes" or "no" option. The total score of the questionnaire is in the range 0 to 15, and according to studies, a score of 0 to 7 indicates low death anxiety, and a score of 8 to 15 indicates high death anxiety (35-37). Studies on the validity and reliability of the death anxiety scale show that the reliability and validity of this instrument are acceptable. This questionnaire is used worldwide to measure death anxiety and is a standard questionnaire. In the primary culture, the reflection coefficient of the scale was 0.83, and its concurrent validity was reported to be 0.27 based on the correlation with the apparent anxiety scale and 0.40 with the depression scale (35). This instrument was used in Iranian studies. The psychometric properties reported acceptable (37).

The reliability and validity of this questionnaire in Iran have been examined by Rajabi and Bahrani, and based on this, the composition reliability coefficient of 0.62 and internal consistency coefficient of 0.73 have been reported. For the validity of the death anxiety scale, two tests of death anxiety scale and overt anxiety scale were used, and the correlation coefficient of death anxiety scale with death anxiety scale was 0.40, and with overt anxiety, the scale was 0.43 (38).

C) Fear of COVID-19 Scale: The Corona Fear Questionnaire was developed by Ahorso et al. in 2020 to measure people's fear of corona and reduce their fear and anxiety. To evaluate the validity and reliability of this questionnaire, 717 Iranian subjects were selected as the sample. This questionnaire has seven items and is based on a five-point Likert scale. Scoring is between 1 and 5. Therefore, the score obtained for each person in this questionnaire will be between 7 and 35, and higher scores indicate higher fear of the coronavirus in them. The correlation between these items has been reported from 0.66 to 0.74. The obtained Cronbach's alpha coefficient is 0.82.

To obtain the validity of this scale, test-retest and concurrent validity were used. The test-retest validity of 0.72 and the concurrent validity of this scale was obtained with the hospital anxiety and depression scale to be 0.425 and 0.511 for the depression and anxiety components, respectively.

Also, the concurrent validity of this scale with the perceived vulnerability to disease scale was 0.471 (39-41). Reliability values of this questionnaire were acceptable in Iran, such as internal consistency ($\alpha = 0.82$) and retest reliability (ICC = 0.72). Concurrent validity with hospital anxiety and depression scale (with depression, $r = 0.425$ and anxiety, $r = 0.511$) and perceived vulnerability to disease scale (with perceived morbidity, $r = 0.483$ and root incompatibility, $R = 0.459$) was supported (42).

D) BAS/BIS Carver and White Scale: This instrument has 24 items made in 1994 by Carver and White. The behavioral inhibition system (BIS) subscale in this questionnaire consists of 7 items (questions 2, 8, 13, 16, 19, 22, and 24) and measures response to threats and feelings of anxiety when faced with a threat. The behavioral activation system (BAS) subscale consists of 13 items, and itself has three subscales called "drive", "reward responsiveness," and "fun-seeking," which is

the 4 item drive subscale (questions 3, 9, 12, and 21), the reward responsiveness has five items (questions 4, 7, 14, 18 and 23) and the fun-seeking has four items (questions 5, 10, 15 and 20). The drive subscale measures the extent to which the desired goals are actively pursued, the reward responsiveness subscale deals with positive responses to the occurrence of a reward or prediction, and the fun-seeking subscale is related to new rewards desire to achieve immediate rewarding events. The answer to this tool is scored on a four-point Likert scale from 1 to 4. Items 1, 6, 11, and 17 have no role in scoring, and questions 2 and 22 also have inverse scoring. According to Carver and White, the internal stability of the BIS scale is 0.73, and the internal stability of the three subscales of drive, reward responsiveness, and fun-seeking is 0.76, 0.73, and 0.66, respectively (43). In a study, Cronbach's alpha coefficient for the BIS scale was 0.78, and the BAS scale was 0.81 (44).

In Iran, in Mohammadi's study in 2008, Cronbach's alpha coefficient for the whole scale was 0.78, for the BIS scale was 0.69, and for the drive scale, reward responsiveness and fun-seeking were 0.74, 0.87, and 0.65 was reported, respectively (45). Psychometric properties of the Persian version of this scale in Iran have been reported by Mohammadi (2008) as desirable in students who lived in Shiraz, Iran. The validity of the retest method was 0.68 for the BAS scale and 0.71 for the BIS subscale (46). Data from this study were collected from all adults interested and volunteered to participate in the study through an online questionnaire (Google Form between July and August 2020). Criteria for inclusion in the study included having a minimum middle school education, no acute medical and psychiatric problems, and willingness to participate. The

exclusion criteria included dissatisfaction with cooperation, the presence of psychiatric and physical disorders, and an incomplete questionnaire. Therefore, the research link was available to people who expressed interest and also had the necessary criteria to participate in the research; Was sent to him whenever he had the opportunity; Complete the questionnaire in such a way that the questionnaire link was sent to the people along with the explanation of the research objectives, and people interested in cooperation, by selecting the submitted link, entered the present questionnaires and proceeded to complete the questionnaire. The questionnaire took an average of 10 to 15 minutes to answer the participants.

Then the collected information was entered into statistical software and used to analyze the research data from descriptive statistical methods, including mean, frequency, and standard deviation, minimum and maximum score, Pearson correlation, and analyze research hypotheses from path analysis. Data were analyzed using SPSS software version 26 and AMOS version 24.

To maintain the principle of confidentiality, the information obtained from the questionnaires was collected without the names and addresses of the subjects to preserve the identity of the subjects and only to the participants of this research.

Also, gaining the trust and confidence of the subjects to participate in the research and being free to answer the questionnaires were among the other considerations that were tried to be observed in this study.

Results

The demographic characteristics of the participants are given in Table 1.

Table 1. Demographic data of participants

Variables	Frequencies	Percentage	
Gender	Male	151	25
	Female	454	75
Marital status	Single	484	80
	Married	121	20
Education	High school and lower	36	6
	Diploma	162	26.8
	Associate degree	23	3.8
	Bachelor	295	48.8
Age	Master and Ph.D.	89	14.7
		M	SD
	27.81	9.31	

The number of participants was 605, and the final analysis was performed on this sample. As Table 1 shows, 25% of the participants were male, and 75% were female. In addition, 20% of them were married, and 80% were single. The mean age of participants was 27.81, and the

standard deviation was 9.31. The majority of participants had a bachelor's degree (48.8%). The mean, standard deviation, and matrix of correlation coefficient of research variables are presented in Table 2.

Table 2. Mean, standard deviation, and correlation coefficient matrix between variables

Variables	M	SD	1	2	3
Fear of the corona	15.51	4.99	1		
Behavioral inhibition	19.05	3.05	0.333**	1	
1. Anxiety of death	7.28	2.11	0.17**	0.29**	1

***P* < 0.01

As Table 2 shows, there was a significant positive correlation between fear of corona and death anxiety (*r*= 0.17). Furthermore, there was also a significant relationship between the behavioral inhibition system and death anxiety (*r*= 0.29). Besides, a significant correlation was observed between fear of corona and the behavioral inhibition system (*r*= 0.333).

Path analysis was used to analyze the descriptive findings. Before presenting the results of path analysis, regression assumptions were examined. Box plot and Q-Q plot were used to evaluate the univariate perturbation data, and Mahalanobis was used to evaluate the multidimensional Perturbation Value in the dependent variable. The results showed that there was no univariate and multivariate perturbation data. The Kolmogorov-Smirnov test was used whether variables are normally distributed or not, which showed that the default was established. To examine the independence of the residues, the Durbin –

Watson statistic was used, the value of which was equal to 0.03, which indicates that the default was observed. The value of the Durbin – Watson statistic tests the null hypothesis that the residual values are not correlated. Its value can be between zero to four.

Multicollinearity of variables was examined using tolerance statistics and variance inflation factor. Examination of tolerance statistics (less than 0.1) and variance inflation index (more than 10) showed that the tolerance values obtained for the variables were above 0.10, and the value of the variance inflation index obtained for the variables was smaller. They are ten, which shows that there was no multicollinearity between the variables. Therefore, path analysis was used to examine the relationship between fear of corona, behavioral inhibition system, and death anxiety. Figure 1 shows the path analysis diagram of the final model, and Table 3 shows the fit indices of the final model in the sample.

Table 3. Results of Kolmogorov-Smirnov test to evaluate the normality of death anxiety

	Skewness	Kurtosis	Value	P	Durbin-Watson
Death anxiety	0.62	0.89	0.14	0.07	0.03

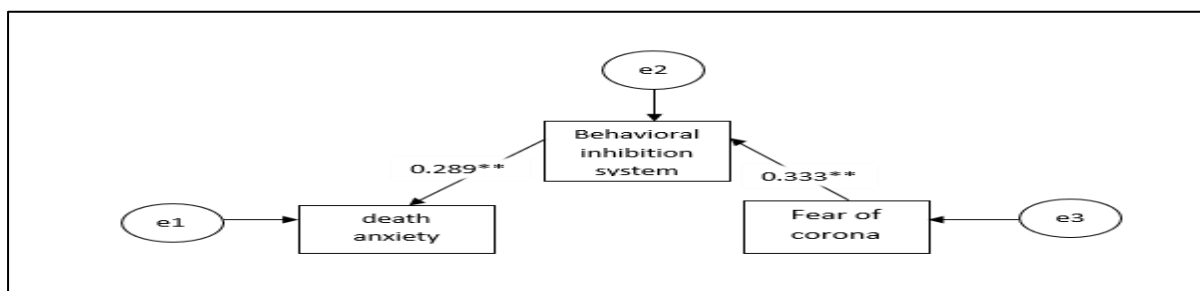


Figure 1. The mediating role of the behavioral inhibition system between fear of corona and death anxiety (N= 605, all paths were standard coefficients and significant (*P*< 0.001)).

Table 4. Fitness indicators of the final model

Fit indices	χ^2	df	χ^2/df	RMSEA	GFI	AGFI	IFI	TLI	CFI	NFI
Acceptable Fit			$3 \geq$	≤ 0.08	≥ 0.9	≥ 0.9	≥ 0.9	≥ 0.9	≥ 0.9	≥ 0.9
Model Estimation value	3.90*	1	3.90	0.06	0.99	0.97	0.98	0.93	0.97	0.96

* $P < 0.05$

Table 4 shows that the fit indices of the final model include the chi-square ($\chi^2 = 3.90$), chi-square /Degree of Freedom (Chi/ df = 3.90), and the Goodness of Fit- Index (GFI= 0.99). , adjusted goodness of fit index (AGFI= 0.97), Comparative Fit Index (CFI= 0.97), Incremental fit Index (IFI= 0.97), Tucker-Lewis Index (TLI= 0.93) and The Root mean square of Error approximation (RMSEA= 0.06) indicates the optimal fit of the final model. All

paths were significant. Therefore, the model in Figure 1 has a good fit.

To determine whether the behavioral inhibition system mediates the relationship between fear of corona and death anxiety, the bootstrap method with 2000 sampling was used to determine the indirect effects. Tables 5 and 6 present the direct and mediating effects of each model path.

Table 5. Parameters measuring direct effects in the final model

Paths	Non-standard estimate	Standard estimate	Standard error	t-statistics	P
Fear of corona to behavioral inhibition	0.204	0.333	0.023	8.68	0.001
Behavior Inhibition System to death Anxiety	0.199	0.289	0.027	7.41	0.001

As shown in Table 5, the standard coefficient of fear of corona pathways to behavioral inhibition system (0.333) and behavioral inhibition system to death anxiety (0.289) was significant. Bootstrap was used to investigate indirect relationships, the results of which are

shown in Table 6. As shown in Table 6, fear of corona to death anxiety through the behavioral inhibition system (0.096) was significant. Therefore, the mediating role of behavioral inhibition was approved.

Table 6. Bootstrap results for testing indirect relationships in the final model paths

Paths	Estimate	Standard Error	Lower	Upper	P
Fear of corona \rightarrow behavioral inhibition \rightarrow death anxiety	0.096	0.019	0.062	0.136	0.001

Discussion

This study aimed to investigate the mediating role of the behavioral inhibition system in the relationship between fear of coronavirus and death anxiety. Findings show a significant relationship between all three variables of fear of coronavirus, behavioral inhibition system, and death anxiety. It also shows that fear of coronavirus can predict death anxiety through the mediating role of the behavioral inhibition system. The present study results showed that fear of coronavirus has a significant relationship with death anxiety. This finding is

consistent with some of its previous studies; For example, in the study of Lee et al., which aimed to investigate the relationship between fear of coronavirus and death anxiety on a sample of 453 people using the Fear Of COVID-19 Scale (FCV-19S) and Templer Death Anxiety Scale (TDAS), the results of hierarchical multiple regression analysis has shown that the concept of death anxiety is growing recently and that fear of coronavirus can predict Generalized anxiety disorder as well as death anxiety among people (11). Previous research has also shown that fears associated with pandemic diseases

such as coronavirus are death anxiety, suicidal ideation, and severe frustration. In Lee's study of a sample of 775 workers in the United States using the Coronavirus Anxiety Scale, the results of hierarchical multiple regression analysis showed that people with weak religious beliefs, severe frustration, and suicidal ideation, as well as having a positive coronavirus test, they also experienced the highest level of coronavirus anxiety (47,48). A study by Lai et al., conducted on 1,257 people in Wuhan, China, using multivariate logistic regression analysis, found that more than half reported severe symptoms of depression, anxiety, and distress. In this regard, people who worked as medical staff in the wards of patients with coronavirus reported more severe degrees of the above symptoms than those who worked as medical staff in other wards (49). Other studies, such as the study by Lee et al., conducted on 398 US adults by analyzing systemic performance characteristics, showed that coronavirus anxiety disorder was associated with dysfunction, worrying about the coronavirus, alcohol, or drug use. Severe frustration and suicidal ideation are associated (50). Similarly, a study conducted by Oren et al. in Turkey through one-way analysis of variance showed that those with a history of anxiety disorders reported more anxiety versus coronavirus (51).

Explaining this finding, it can be said that some recent studies consider death anxiety the same as fear of death (52,53). Furthermore, the number of deaths from coronavirus is increasing day by day (17), and its epidemic and continuous reporting in the media, psychological problems associated with anxiety such as anxiety, depression, and insomnia have increased (54,55). This can lead to more fear of death and thus increase their anxiety, whether death anxiety or coronavirus anxiety (11,56).

The results also showed that the behavioral inhibition system is associated with death anxiety. This research finding is in line with the results of the research of Campbell-Sills et al. In the study of Campbell-Sills et al., which was conducted to evaluate and treat anxiety and mood disorders on 1825 people, the results of analysis of the covariance matrix showed that the behavioral inhibition system has a significant relationship with death anxiety (25). Furthermore, in a study by Rosenbaum et al. conducted on a sample of 56 children aged 2 to 7 years who had parents with a diagnosis of

anxiety disorders. The results showed that the behavioral inhibition system is associated with death anxiety (57). Also, the results of modified regression analysis in the study of Agroskin et al., which was performed on 74 students of the University of Salzburg, Austria, showed that high activity of the behavioral inhibition system with reminders about mortality would lead to high death anxiety in individuals (58).

In explaining this relationship, it can be said that since the increase in the activity of the behavioral inhibition system manifests itself by extreme avoidance of unfamiliar situations and reduced motivation (58); So one is always careful not to put oneself in unfamiliar situations, which causes one to focus more on death, which in turn increases one's anxiety about death.

In addition, the finding that fear of coronavirus is associated with behavioral inhibition can be equated with the finding that the emotions that may arise from the activation of the behavioral inhibition are fear, frustration, and anxiety (59). For example, in the Smiths and Kuppens study of 323 Belgian psychology students, the results of hierarchical regression analysis showed that negative experiences such as feelings of fear and anxiety were predicted through the behavioral inhibition system (60). Furthermore, in a study by Yan and Dillard on 305 University of Pennsylvania students, the results of a one-way analysis of variance showed that individuals scored high on the behavioral inhibition system under conditions of fear and anxiety (61). However, the results of the research of Sadikovic et al., which was performed on a sample of 444 people in Serbia, are inconsistent with the present findings. In this study, the results showed that people with high sensitivity in the behavioral inhibition system did not experience more fear and anxiety than other people (62). Although there are reasons why these results are different, including the fact that the present study in Iran and Sadikovic in Serbia was conducted and that the tools used were different, it can be said that how the two countries cope and adapt to coronavirus has been different. Also, in the study of Kimbrel et al., which was conducted on 207 students, through the structural equation model, they showed that the behavioral inhibition system is related to anxiety (63). In this regard, in a study conducted on 399 undergraduate students in Iran through path analysis, Heidari and Nemat Tavooosi showed

that social anxiety is related to the behavioral inhibition system (64). An important finding of our study was the role of the behavioral inhibition system in predicting death anxiety. Why do people with higher levels of behavioral inhibition system experience higher death anxiety? One explanation could be that health concerns and anxiety associated with pandemic diseases, including coronavirus, can have significant psychological effects, such as stress and negative automatic thoughts, leading to dysfunctional preventive behavior and behavioral inhibition that may have no scientifically preventive benefits but have long-term adverse consequences for the individual (10), including long-term adverse effects like death anxiety (11,58).

In the generalizations of this research, its limitations should always be considered. Among the limitations during the research is the increase in the prevalence of coronavirus in Iran and the absence of most activities that forced researchers to perform electronic and not in-person questionnaires, as a result of which people who do not have Internet access are not included in this study. Another limitation is the use of self-reporting instruments, which always raises the concern of honesty and accuracy of responses, as there is a possibility of bias in this situation. However, the results of the present

study on the significant relationship between fear of coronavirus and behavioral inhibition system and the interactive role of these two variables in predicting death anxiety are worth considering and require more extensive research. Furthermore, by using cognitive tests, especially in inhibition and behavioral activation systems, more accurate findings can be obtained about the underlying factors of this relationship.

Conclusion

The present study predicts death anxiety by showing the mediating role of the behavioral inhibition system in fear of coronavirus. Therefore, interventions based on the introduction of prevention to coronavirus to reduce the fear of people being infected with it, as well as informing them about the specific function of their behavioral inhibition system during this period and the consequences that will follow, can be considered as prevention programs to help people overcome experienced death anxiety.

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