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# Predicting COVID-19 anxiety based on cognitive flexibility mediated by self-compassion in students

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**Abstract**---The aim of this study was to predict covid-19 anxiety based on cognitive flexibility, considering the mediating role of self-compassion in students. The research method was descriptive-correlation and specifically structural equations. The statistical population in the present study included all male high school students in the second academic year 2020-2021 District 3 of Kermanshah, from which 322 students were selected as a research sample using multi-stage cluster sampling. To collect data, corona disease anxiety Alipour et al (2020) questionnaire, Neff (2003) self-compassion questionnaire and Dennis and Vander Wal (2010) cognitive flexibility questionnaire were used. Data analysis was performed by structural equation method using Amos software. The results showed that cognitive flexibility with mediating role of self-compassion ( $\beta = -0.16$ ) is indirectly related to covid-19 anxiety, which is statistically with 99% confidence with is significant ( $p \leq 0.01$ ). Also, between direct relationships, flexibility ( $\beta = -0.45$ ) and self-compassion ( $\beta = -0.43$ ) are directly and significantly related to covid-19 anxiety, and cognitive flexibility is directly related to self-compassion ( $\beta = 0.38$ ). All these relationships are statistically significant with 99% confidence ( $p \leq 0.01$ ).

**Keywords**---COVID-19 anxiety, Cognitive Flexibility, Self-Compassion, Students.

## Introduction

Coronavirus epidemics have caused various negative psychological effects. Psychological disorders have been proven in a wide range of patients recovered from Coronavirus disease patients (Mazza et al., 2020). These injuries have previously been reported in SARS patients (Cheng et al., 2004). With regard to the people who are at risk, the occurrence of stressful events such as fear of infection, exaggerated fear of death and fear of loss loved ones are among these psychological effects (Rodriguez et al., 2021). The mental health care needs of people suffering from this crisis have been neglected (Xiang et al., 2020). Among all the periods in one's life, adolescence has a particular importance. During this period, poor mental health can jeopardize the future growth and potential of adolescents (Wambua et al., 2018). During the coronavirus epidemic, fundamental social changes and disruptions in adolescents' daily activities have made their development and well-being vulnerable. Loss of important turning points (e.g., graduation and school social events) and major disruptions in peer interactions and experiences may severely affect adolescents' feelings, behavior, and identity development (Ferguson, 2021).

Anxiety is one of the most common psychological injuries during coronavirus epidemic. Anxiety leads to feelings of stress, and physical changes such as high blood pressure, sweating, tremors, dizziness, or rapid heartbeat (Major et al., 2000). Covid-19 anxiety is a state of anxiety that cognitively causes a person to be anxious and afraid of getting coronavirus or those around him or her, and physically causes a person to experience symptoms such as physical stress, anorexia and sleep disorders (Alipour et al., 2019; Al-Hindi, Y., et al., 2021; Siyal, F. J., et. al., 2020). Anxiety about getting sick or fear of dying from coronavirus can lead to helplessness, frustration, fatigue, burnout, negative emotions, as well as work-life imbalances (Mukhtar, 2020). Various studies have proven the increase in anxiety in children and adolescents during coronavirus epidemic (Briggs and Kattey, 2020; and Nathya et al., 2020). There is a growing concern about coping with anxiety as well as its long-term individual and collective effects. One of the mental abilities protecting people health against negative psychological conditions is cognitive flexibility. Various studies have proven the inverse relationship between cognitive flexibility and types of anxiety (Yangjuan et al., 2020; and Rosa-Alcázar et al., 2019, Scott (1962)). Scott (1962) defines cognitive flexibility as the ability to transfer thinking from one concept to another. It defines simultaneous attention to several concepts and shift of intellectual focus according based on the changes and environmental requirements Cognitive flexibility is the ability to adapt cognitive processing strategies to environmental changes (Canas et al., 2003). Cognitive flexibility can potentially enable a person to cope with external and internal stressors. This ability predicts well-being, self-esteem, mental health and physical health (Kuesten et al., 2009).

Another cognitive trait that helps to people adaptation is self-compassion. Self-compassion is defined as a kind of adaptive relationship with oneself that requires kindness and self-understanding rather than intense self-criticism in failures (Hanh, 1997). Cognitive flexibility seems to help reduce anxiety through self-compassion. Theoretically, self-compassion and cognitive flexibility are significantly related. Cognitive flexibility, as a basic cognitive ability, seems to

improve the self-compassion. In other words, it can be stated that cognitive flexibility increases the ability to shift focus from self-critical to self-compassion, thereby reducing negative emotions and anxiety. The studies conducted by Marshall and Brockman (2016) and Matthew et al. (2011) have proven the relationship between psychological flexibility and self-compassion.

Self-compassion includes the three components of kindness to self-judgment, understanding negative experiences as part of a shared human experience of isolating oneself, and mindfulness of painful thoughts and feelings rather than avoiding them (Neff, 2003). Compassion is associated with increased levels of reflective and emotional wisdom, personal initiative, curiosity and exploration, happiness, optimism and positive emotion (Neff et al., 2007). Mindfulness as one of the components of self-compassion makes it possible to understand that although negative emotions may occur, they are not a permanent part of one's identity (Bishop, 2004). Mindfulness is effective in increasing self-esteem and resilience (Abolfazli et al., 1399). Also, this component is inversely related to anxiety (Saeed and Dortaj, 2018).

Given what was stated above, and the importance of identifying the factors associated with Covid-19 anxiety during this virus outbreak, and since no study has been conducted to predict Covid-19 anxiety based on cognitive flexibility with mediating role of compassion, it was essential to conduct this research. Given the relevance of the concepts described above, it seems that compassion itself can play a mediating role in the relationship between cognitive flexibility and Covid-19 anxiety. Hence, the present study seeks to answer the question of whether Covid-19 anxiety can be predicted based on cognitive flexibility with the mediating role of self-compassion.

## **Methods**

The present study was applied research in terms of aim and non-experimental in terms of data collection. Its analysis was non-experimental and correlation designs were structural equation modeling. The aim of the present study was to predict Covid-19 anxiety based on cognitive flexibility by considering the mediating role of self-compassion. The statistical population in the present study included all male high school students in the second academic year of 2020-2021 in 3<sup>rd</sup> District of Kermanshah, which 322 students were selected as a research sample using multi-stage cluster sampling.

## **Measurement tool**

Alipour et al. (2019) Corona Disease Anxiety Scale: This tool has 18 items and 2 components of psychological and physical symptoms. It was developed and validated to measure Covid-19 anxiety in Iran. Psychological symptoms are measured by questions 1 to 9 and physical symptoms are measured by questions 10 to 18. The questionnaire has 4-point Likert scale (never = 0, sometimes = 1, most times = 2 and always = 3). Cronbach's alpha was obtained at 0.879 and 0.861, respectively, for the sub-component of psychological symptoms and physical symptoms and it was obtained at 0.919 for the whole questionnaire. Alipour et al. (2017) reported the validity of the questionnaire at desirable level.

The reliability for the whole questionnaire in the present study using Cronbach's alpha was obtained at 0.95 and 0.87 and 0.84, respectively, for the components of psychological and physical symptoms.

Dennis & Vander Wal (2010) Cognitive Flexibility Inventory: This inventory has 20 questions that measure cognitive flexibility, which includes three factors of alternatives, control and alternatives to human behaviors. The inventory has a 7-point Likert scale that is scored from strongly agree = 1 to strongly agree = 6. The questions 2, 4, 7, 9, 11, 17 are scored in reverse.

In the study conducted by Dennis & Vander Wal (2010), the concurrent validity of this inventory with Beck Depression Inventory (BDI-II) was -0.39, and its convergence validity with Martin and Robin Cognitive Flexibility Scale was obtained at 0.75. The reliability for the whole inventory was obtained at 0.85 in the present study using Cronbach's alpha and 0.84, 0.82, and 0.70, respectively, for the components of alternatives, control and alternatives for human behaviors. Neff Self-Compassion Scale (2003): This scale, developed by Neff (2003), measures self-compassion. It consists of subscales of self-kindness, common humanity, and mindfulness. The inventory has a 5-point Likert scale from almost never = 1 to almost always = 5. Questions 1-2-4-6-8-11-13-16-18-21-21-24 and 25 are scored in reverse. Neff (2003) reported the validity of the inventory at desirable level. Its test-retest reliability was obtained at 0.93 and its Cronbach's alpha was obtained at 0.92. The reliability of the whole scale in the present study using Cronbach's alpha was obtained at 0.78 and for the components of self-kindness, common humanity, and mindfulness, it was obtained at 0.73, 0.71 and 0.70, respectively.

## Results

Among the people who answered the questionnaires, 132 (40.9%) were tenth grade, 111 were eleventh grade (34.4%) and 79 (24.7%) were in twelfth grade. Before examining the hypotheses, descriptive statistics of research variables including (mean, standard deviation, skewness and elongation) were examined. The complete results are presented in Table 1.

Table 1  
Descriptive indices of research variables

| Variable              | mean | SD   | Skewness | Kurtosis |
|-----------------------|------|------|----------|----------|
| Covid-19 Anxiety      | 2.31 | 6.13 | 216..0   | 389.0    |
| Self-compassion       | 2.78 | 9.13 | 419.-0   | 815.0    |
| Cognitive flexibility | 4.89 | 7.17 | 517.-0   | 640.0    |

Before examining the relationships, the assumptions of the structural equation method were examined. Mahalanobis distance was used to examine multivariate outlier data. The critical value  $X^2/df$  (number of independent variables) at the level of 0.001 was 13.816. None of them exceeded this limit and the observed values were less than the critical value. Therefore, the assumption of the absence

of multivariate outlier data in independent variables was observed. The hypothesis of multicollinearity was also examined and the results showed that there was no linear multicollinearity between the independent variables.

Pearson correlation method was used to examine the correlation matrix between research variables. As seen from the results of Table 2 related to the correlation matrix between the research variables, all research variables have a significant correlation with each other \*\* ( $p \leq 0.01$ ). In general, investigating the correlation matrix between the variables showed that there was no relationship with very high intensity that caused multicollinearity and a non-significant relationship that caused their independence from each other in the variables. Thus, the required correlation was provided to continue the analyses using structural equations.

Table 2  
Correlation matrix between research variables \*\* ( $p \leq 0.01$ )

| Variable              | 1      | 2      | 3 |
|-----------------------|--------|--------|---|
| Covid-19 Anxiety      | 1      |        |   |
| Self-compassion       | .487** | 1      |   |
| Cognitive flexibility | .655** | .513** | 1 |

To examine the fit of the main research model, structural equation analysis using AMOS software was used. The results of the first-order confirmatory factor analysis as the variables observed in the hypothetical research model are presented in Figure 1. Due to the complexity of the model and the number of variables observed in this model, the item parceling method was used to observe the law of parsimony. In this method, according to the existing psychometric properties, each group of items is considered as a parcel. One of the advantages of this method is observing the law of parsimony, avoiding the complexity of the model and better fitting the data with the model. Based on the characteristics of the existing questionnaires, 4 parcels were considered for the Covid-19 anxiety variable and 3 parcels were considered for self-compassion.

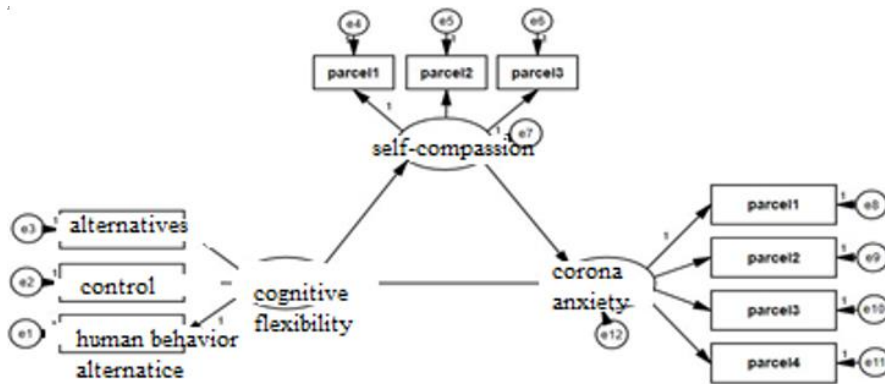


Figure 1: Hypothetical research model derived from research background

Bootstrap method was used to examine the mediating role of variables and calculate significance levels in this study. The results of structural equation analysis using experimental data showed that cognitive flexibility is related to Covid-19 anxiety due to the mediating role of self-compassion. The results of some of the most important fit indices are presented in Table 3.

Table 3  
Fit indices of structural equation research model

| Index name         | Fit adequacy level | Desirability  |
|--------------------|--------------------|---------------|
| X <sup>2</sup> /DF | 37.2               | Less than 4   |
| RMSE               | 059.0              | Less than 0.1 |
| NFI                | 964.0              | Above 0.90    |
| CFI                | 979.0              | Above 0.90    |
| GFI                | 964.0              | Above 0.90    |
| AGFI               | 939.0              | Above 0.90    |

The results of Table 3 showed that all indices are reported at desirable level and the model fits well with the data and the desirability values are relative, indicating that there is a linear relationship between variables and latent structures. The standardized path coefficients and errors of each indicator in the proposed model are reported below.

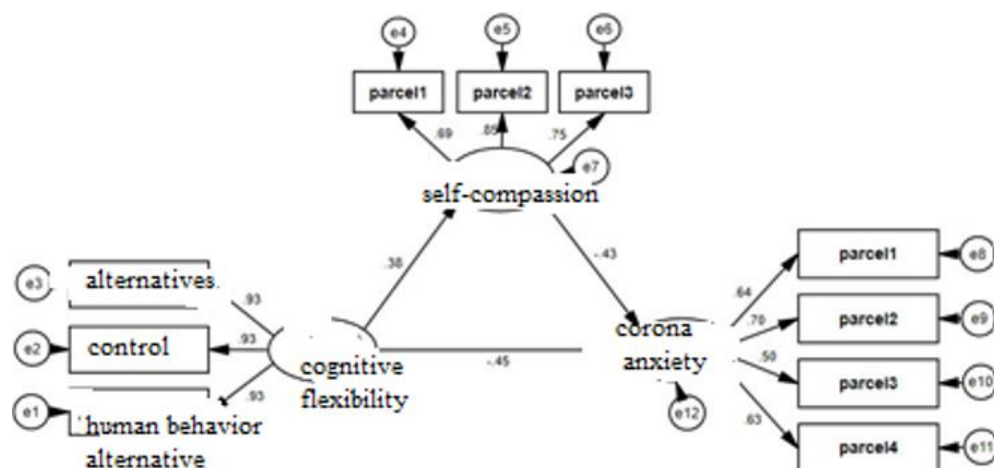


Figure 2: Standardized coefficients of structural equation analysis model

The research model presented in Figure 2 is recursive, meaning that all paths are one-way. In the initial model, cognitive flexibility has relationship with Covid anxiety given the mediating role of self-compassion. Since the paths between the latent variables are the same as the research hypotheses in the analyzed path analysis model, the direct and indirect relationships of the research hypotheses are tested. Table 4 shows the value of the coefficient and its significant statistics.

Table 4  
Coefficients and significance of indirect relationship between research variables

| Independent variable  | Dependent variable | Mediating variable | Type of relationship | Path coefficient | SE    | sig   |
|-----------------------|--------------------|--------------------|----------------------|------------------|-------|-------|
| Cognitive flexibility | Covid-19 Anxiety   | Self-compassion    | indirect             | 16.-0            | -     | 001.0 |
| Cognitive flexibility | Covid-19 Anxiety   | -                  | Direct               | 45.-0            | 006.0 | 001.0 |
| Self-compassion       | Covid-19 Anxiety   | -                  | Direct               | 43.-0            | 119.0 | 001.0 |
| Cognitive flexibility | Self-compassion    | -                  | Direct               | 38.0             | 003.0 | 001.0 |

Based on the results of path analysis using the bootstrap test in Table 4, cognitive flexibility is indirectly related Covid-19 anxiety with a mediating role of self-compassion ( $\beta = -0.16$ ), which is statistically significant with the value of  $p \leq 0.01$  at 99% confidence interval. Also, there is a significant and direct relationship between flexibility ( $\beta = -0.45$ ) and self-compassion ( $\beta = -0.43$ ) and Covid-19 anxiety, and cognitive flexibility has a direct relationship with self-compassion ( $\beta = 0.38$ ). All these relationships are statistically significant at a 99% confidence interval with a value of  $p \leq 0.01$ .

## Discussion and Conclusion

The results of data analysis showed that the Covid-19 anxiety prediction model based on cognitive flexibility considering the mediating role of self-compassion has a good fit based on experimental data and the relationships between variables are significant. Regarding the relationship between cognitive flexibility and Covid-19 anxiety with a mediating role of self-compassion, it can be said that during coronavirus anxiety, cognitive flexibility helps individuals to shift from a deep focus on the coronavirus crisis to see it as a common experience of human beings and be kind in the face of this situation. This issue reduces Covid-19 anxiety in people. This explanation is somewhat consistent with the results of a study conducted by Basharpour and Shafiei (2017).

It can be stated that people with high cognitive flexibility can consider several options, so in coronavirus situations. Hence, they consciously accept the situation created and this will reduce their coronavirus anxiety. The positive relationship between cognitive flexibility and self-compassion has also been proven in the research conducted by Matthew et al. (2011). The relationship between cognitive flexibility and self-compassion has also been proven in Marshall and Brockman (2016). Also, the inverse causal relationship between self-compassion and stress headache has been proven by Tofangchi et al. (1400). It can be stated that cognitive flexibility through the path of self-compassion reduces the stress headaches of Covid-19 anxiety.

Several studies have proven the inverse relationship between cognitive flexibility and types of anxiety (Yangjuan et al., 2020; and Rosa-Alcázar et al., 2019). Also, studies have shown that people with high self-compassion are less likely to respond to negative events, have higher positive emotions, better mental health, and report more life satisfaction than people with low self-compassion (Allen and Leary, 2010). Neff et al. (2007) also found that self-compassion is associated with increased levels of reflective and emotional wisdom, personal initiative, curiosity and exploration, happiness, optimism, and positive emotion. Given the positive relationship between cognitive flexibility and self-compassion, it can be said that cognitive flexibility increases the capacity for positive emotions, and self-compassion reduces the experience of Covid-19 anxiety by creating positive emotions.

With regard to the direct relationship between cognitive flexibility and Covid-19 anxiety, it seems that cognitive flexibility can increase adaptive responses, increase resilience, and decrease hopelessness by changing the responses in proportion to coronavirus environmental changes in students, resulting in reduced coronavirus anxiety. The relationship between cognitive flexibility and resilience and its inverse relationship with hopelessness has been proven the studies conducted by Taghizadeh and Farmani (2013). Also, the inverse relationship between resilience and hope and anxiety has been proven by the research conducted by Janadeleh et al., (2018). Furthermore, the inverse relationship between cognitive flexibility and rumination has been proven and increasing cognitive flexibility and teaching it to patients is useful for treating depression (Nofarasati et al., 2014). Cognitive flexibility seems to help students overcome coronavirus anxiety by reducing rumination.

With regard to the limitations of the present study, due to the use of self-reporting tools, the results may be biased. Also, since the present study was conducted in the population of high school students in 3<sup>rd</sup> district of Kermanshah, by extending the results to other populations, the external validity of the results may decrease. To investigate the experimental relationship between the studied variables, the use of experimental methods in future research is recommended. Also, considering the mental health crisis caused by the coronavirus epidemic and considering the results of this study, it is recommended to use methods that reduce cognitive flexibility and self-compassion to reduce coronavirus anxiety in students.

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