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Developing A Structural Model of Psychological Flexibility Based on Self-Compassion with the Mediating Role of Sleep Quality and Psychological Hardiness

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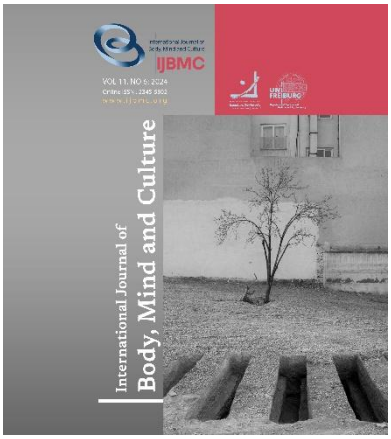

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ABSTRACT

Objective: Sleep quality is defined as a cycle of invigorating sleep that fulfills the needs related to sleep and allows a person to perform daily tasks and functions correctly. The present study develops a structural model of psychological flexibility based on self-compassion with the mediation of sleep quality and psychological hardiness.

Methods and Materials: The method of this study was descriptive-correlational based on the structural equation model. The statistical population of this study included all the students living in the student dormitory of Isfahan University in the academic year 2022-23. Among them, 478 people were selected by a convenience sampling method. The Pittsburgh Sleep Quality Questionnaire (Buysse et al., 1989) and the Psychological Hardiness Questionnaire (Kobasa et al., 1982) were used to gather the data. The data were analyzed statistically using the Pearson correlation coefficient, path analysis, structural equations, and AMOS 24 software.

Findings: The results revealed that the total path coefficient (sum of direct and indirect path coefficients) between self-compassion and psychological flexibility was positive and significant ($p<0.01$, $\beta=0.53$). The direct path coefficient between self-compassion and sleep quality was negative and significant ($p<0.01$, $\beta=0.67$). The direct path coefficient between self-compassion and psychological flexibility was insignificant ($p<0.05$, $\beta=0.06$). The path coefficient between sleep quality and psychological flexibility was insignificant ($p<0.05$, $\beta=0.01$). A positive and significant relationship was found between psychological hardiness and psychological flexibility ($p<0.01$, $\beta=0.47$).

Conclusion: It can be concluded that the two mediating variables of sleep quality and psychological hardiness significantly mediate the effect of self-compassion on psychological flexibility.

Keywords: Self-Compassion, Sleep Quality, Models, Structural.

Introduction

Sleep quality is defined as a cycle of invigorating sleep that fulfills the needs related to people's sleep and allows a person to perform daily tasks and functions properly (Ahmadi, 2024; Fabbri et al., 2021). One of a person's basic physiological demands is sleep. When the cycle of sleep and wakefulness is disturbed, other physiological functions of the body are also affected. Chronic insomnia can cause heart disease, hypertension, neurological diseases, respiratory problems, urinary problems, chronic pains, and digestive problems (Hajatnia et al., 2023; Scott et al., 2021). Hence, it is crucial to pay attention to the sleep issue. In stressful situations, a person's hardiness serves as a source of resistance and a protection barrier. (Gupta et al., 2020). Psychological hardiness is a general tendency toward self and the

surrounding world and includes three components: commitment, control, and challenge (Banisafar et al., 2023; Pinto et al., 2020; Shahidi et al., 2021). Also, mental stress causes sleep disturbances. Thus, strategies that effectively solve sleep problems are considered (Jahrami, 2021). Psychological flexibility is another variable that may be related to the level of sleep quality. It is defined as a dynamic process responsible for the adaptation of a person despite the existence of various experiences. It plays a significant role in people's lifestyle and acceptance or non-acceptance of life incidents.

People's flexibility is very decisive in the occurrence of disorders and their level of social function (Doorley et al., 2020). Psychological flexibility is one of the most fundamental dimensions of cognitive functions and one of the most significant elements of executive functions. It refers to a person's ability to change thoughts, actions, and strategies in response to changing conditions (Dawson & Golijani-Moghaddam, 2020). Flexible cognition requires the activation and modification of cognitive processes in response to a need for a change in performing an activity or even a change in the guidelines for conducting an activity (P. Alizadeh et al., 2023; Z. Alizadeh et al., 2023; Kroska et al., 2020). It is described as a significant feature of human cognition and refers to a person's ability to simultaneously consider contradictory representations of an object or an event (Tindle et al., 2022). People's flexibility is very crucial in the level of injuries and their level of social function. People who can think flexibly use alternative justifications and positively reconstruct their thinking framework. They accept challenging situations or stressful events and have higher psychological resilience than people with little flexibility (Feather & Williams, 2022). Given the relationship between cognitive flexibility and psychological adjustment (Arslan & Allen, 2022) and emotion regulation (Mendes et al., 2023), having more psychological flexibility and cognitive emotion regulation leads to better control of emotions and higher quality of sleep (Thompson et al., 2022).

With an increase in the number of studies in this area, a new construct, namely self-compassion, was proposed in psychology. Neff (2003) defined self-compassion as a three-component construct, including self-kindness versus self-judgment, common humanity versus isolation, and mindfulness versus overidentification (Movahedrad et al., 2023). Accordingly, self-kindness requires support and understanding instead of blaming and criticizing yourself for your shortcomings and defects, comforting yourself in times of distress, and finally, unconditional acceptance of yourself (Sadeghian-Lemraski et al., 2024). Common humanity requires awareness of the pain and suffering experienced in the present without ignoring it or leading to rumination (Miyagawa et al., 2022). This supportive attitude toward self is related to many positive psychological outcomes such as more motivation to solve interpersonal conflicts, constructive problem solving, less fear of failure, and other cases (Liao et al., 2021). Several studies have been conducted on the relationship

Between self-compassion and health. Self-kindness is positively related to health-promoting behaviors (Muris & Otgaar, 2020). It is a strong predictor of healthy attitudes toward psychological growth and development. The relationship between self-kindness and well-being outcomes mediates attitude toward physical changes in midlife (Mendes et al., 2023). Several studies have shown an association between self-kindness and pain (Kramer et al., 2023; Tran et al., 2022) and the effectiveness of mindfulness (one of the components of self-compassion) in sleep quality (Javadi & Ghorbani, 2019; Rusch et al., 2019). Given the above, the present study develops a structural model of psychological flexibility based on self-compassion with the mediation of sleep quality and psychological hardiness.

Methods and Materials

Study Design and Participants

The method of this study was descriptive-correlational based on the structural equation model. The statistical population of this study included all the students living in the student dormitory of Isfahan University in the academic year 2022-23. Among them, 478 people were selected using a convenience method. The inclusion criteria of studying at the bachelor, master, or doctoral level and having an age below 55. The exclusion criteria were the lack of answers to all the research questionnaire questions. Based on Kline's (2016) opinion, the sample was 450 people. However, 500 questionnaires were submitted among the subjects, and after removing incomplete questionnaires, 478 questionnaires remained. The researcher referred to the

student dormitories of Isfahan University based on the ease of access to the study's statistical population.

The researcher started collecting data after introducing himself and obtaining informed consent from the participants. The participants were assured that their answers would stay private and only be used for research, and all surveys were anonymous. Also, the study's purpose and other conditions were explained to the participants.

Data Collection Tools

Pittsburgh Sleep Quality Questionnaire (PSQ): The Pittsburgh Sleep Quality Questionnaire is one of the most common tools to diagnose insomnia or lack of sleep. This questionnaire was developed by Buysse et al. (1989) to assess sleep quality and to help distinguish between those who have good sleep and those without good sleep (Buysse et al., 1989). Despite a small number of its questions (18 questions), it explores many aspects of sleep and has seven components, including sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, the use of sleeping medications, and daytime (Buysse, 2003). Using these questions, one can find out the level of satisfaction of the person with their sleep and perception of sleep. The answers have 0 to 3 scores, and the total score will be from 0 to 21. The validity of this questionnaire was verified in a study by (Heidari et al., 2010) using the confirmatory factor analysis approach, and the reliability of this questionnaire was obtained at 0.79 using Cronbach's alpha method. Buysse, Reynolds, and Monk (1989) received the internal consistency of the questionnaire at 0.89 using Cronbach's alpha.

Psychological Hardiness Questionnaire: Psychological Hardiness Questionnaire was developed by (Kobasa, 1990) to measure hardiness. This test consists of 20 questions with four options (never, rarely, sometimes, and often). This test was standardized by Zare and Aminpour (2011) on the Payam Noor University students. Three factors were extracted after seven iterations based on the principal component analysis and Varimax rotation. These three factors explain 50.16% of the total variance of the test. Kobasa (1990) considers this test to have good construct validity. The total score of the questions is regarded as the subject's hardiness score. A higher score indicates higher hardiness, and vice versa. The studies by (sheikhesmaeili et al., 2020) showed the appropriate internal consistency of this questionnaire. Cronbach's alpha coefficient of the total score, commitment, control, and challenge was obtained at 0.91, 0.84, 0.82, and 0.75, respectively.

Neff Self-compassion Questionnaire (2003): The self-compassion questionnaire was developed by Neff in 2003. It had 26 items, each graded on a Likert scale of one to five, with 5 being the highest score (almost always). This scale compares mindfulness versus overidentification, common humanity versus isolation, and self-kindness versus self-judgment. (Neff, 2003). Saeedi et al. (2012) reported Cronbach's alpha coefficient of the self-compassion questionnaire at 0.93 in Iran. Also, in the study by (Neff, 2003) in Thailand, Taiwan, and America, Cronbach's alpha coefficients were obtained at 0.87, 0.95, and 0.86. Momeni et al. (22) reported Cronbach's alpha reliability coefficient at 0.71 for common humanity and mindfulness, 0.75 for self-kindness, 0.72 for isolation, and 0.65 for overidentification. Psychological Flexibility Questionnaire: This questionnaire was developed by Dennis et al. in 2010. It is a short self-report tool with 19 items scored on a 7-point scale from strongly disagree to agree strongly. Fazeli et al. obtained internal consistency of this questionnaire for the whole scale of perception of control and perception of different options at 0.91, 0.91, and 0.84, respectively, by the Cronbach's alpha method, and by retest method, and 0.81, 0.75, and 0.78, respectively, by the test-retest method.

Data analysis

Mean and standard deviation were used to analyze the data at the descriptive level, and path analysis and structural equations were used at the inferential level. Software programs SPSS 22 and AMOS 24 were used for all analyses.

Findings and Results

In the present study, 370 (77.4%) females and 109 (22.8%) males participated. The participants' mean (standard deviation) age was (10.11) 20.30 years. Table 1 shows the studied variables' mean, standard deviation, and Cronbach's alpha coefficients.

Table 1

Mean (SD) and Cronbach's alpha coefficient of the variables

Variable	Mean	SD	Cronbach's alpha
Sleep Quality	0.64	0.98	0.72
Sleep latency	2.92	0.36	0.67
Sleep duration	6.47	1.59	0.83
Habitual sleep efficiency	6.55	1.61	0.70
Sleep disturbances	6.39	4.36	0.76
The use of sleeping medications	0.34	0.84	0.68
Daytime dysfunction	2.26	1.73	0.77
Challenge	19.3	4.8	0.68
Control	16.1	4.1	0.73
Commitment	16.2	3.7	0.75
Self-kindness	6.18	2.00	0.63
Self-judgment	5.95	2.18	0.85
Common humanity	6.12	2.05	0.73
Isolation	6.30	2.42	0.71
Mindfulness	6.29	2.19	0.80
overidentification	6.19	2.45	0.72
Psychological flexibility	42.52	9.04	0.75

Table 1 shows the Cronbach's alpha coefficients of each variable and the research variables' mean and standard deviation. As seen, Cronbach's alpha coefficients of all components are close to or higher than 0.7, indicating that the items of each questionnaire used to measure the research variables have an acceptable internal consistency. The correlation matrix between the research variables is displayed in Table 2.

Table 2

Results of multivariate tests of research variables

Var.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	-																
2	0.47**	-															
3	0.68**	0.59**	-														
4	0.32**	0.19**	0.26**	-													
5	0.43**	037**	0.43**	0.54**	-												
6	0.19**	0.14**	0.10	0.42**	0.29**	-											
7	0.26**	0.21**	0.29**	0.41**	0.40**	0.56**	-										
8	0.28**	0.17**	0.28**	0.19**	0.33**	0.12*	0.17**	-									
9	0.32**	0.17**	0.30**	0.23**	0.34**	0.11*	0.14**	0.60**	-								
10	0.25**	0.09	0.24**	0.19**	0.27**	0.26**	0.21**	0.66**	0.69**	-							
11	0.31**	0.14**	0.30**	0.18**	0.30**	0.26**	0.02	0.53**	0.63**	0.53**	-						
12	0.24**	0.11*	0.26**	0.13*	0.28**	0.29**	0.04	0.58**	0.67**	0.75**	0.64**	-					
13	0.26**	0.08	0.22**	0.19**	0.31**	0.33**	0.01	0.61**	0.63**	0.68**	0.51**	0.60**	-				
14	0.17**	0.11*	0.41**	0.13*	0.18**	0.51**	0.11*	0.42**	0.38**	0.42**	0.26**	0.63**	0.31**	-			
15	0.38**	0.22**	0.35**	0.21**	0.32**	0.26**	0.26**	0.29**	0.26**	0.21**	0.29**	0.44**	0.24**	0.21**	-		
16	0.33**	0.26**	0.35**	0.19**	0.34**	0.29**	0.29**	0.33**	0.34**	0.30**	0.33**	0.25**	0.28**	0.19**	0.18**	-	
17	0.31**	0.24**	0.35**	0.17**	0.36**	0.38**	0.33**	0.31**	0.41**	0.36**	0.29**	0.28**	0.33**	00.17**	0.32**	0.19**	-

*p<0.05; **p<0.01; 1. Sleep Quality; 2. Sleep latency; 3. Sleep duration; 4. Habitual sleep efficiency 5. Sleep disturbances 6. The use of sleeping medications 7. Daytime dysfunction 8. Challenge 9. Control 10. Commitment 11. Self-kindness 12. Self-judgment 13. Common humanity 14. Isolation 15. Mindfulness 16. overidentification 17. Psychological flexibility.

The correlation coefficients between the variables used in the current study are displayed in Table 2. The correlation coefficients between the variables were in the expected direction and aligned with the theories of the research field. To examine the assumption of normality of univariate data distribution, skewness and kurtosis of each variable were calculated. The variance inflation factor and the tolerance coefficient of the predictor variables were calculated to examine the assumption of collinearity.

The variables' skewness and kurtosis values fall between -2 and +2. It indicates that the data distribution

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related to the study's variables has no noticeable deviation from the univariate normality. Results show that all predictor variables' tolerance coefficient values are more significant than 0.1, and their variance inflation factor values are smaller than 10. Thus, it can be stated that the assumption of collinearity among the present study's data has been fulfilled. In this study, the analysis of information related to the Mahalanobis distance and the drawing of its distribution diagram was used to confirm or reject the assumption of normality of multivariable distribution. The skewness and kurtosis values of the Mahalanobis distance scores were obtained as 1.49 and 3.43, respectively. Hence, the kurtosis value of the stated index was more significant than 2, indicating that the assumption of normality of multivariate data distribution among the data is not fulfilled.

For this reason, the boxplot diagram was drawn, and it was found that the information about the two outlier participants formed a multivariable. Then, the information of the mentioned two participants was removed from the data, and it reduced the values of skewness and kurtosis to 1.17 and 1.63, respectively. In other words, after removing multivariate outliers, the assumption of normal distribution of multivariate data was fulfilled among the data.

Table 3

The fit of the initial measurement model, adjusted measurement model, and structural model

Fit indices	Initial measurement model	Adjusted measurement model	Structural model	Cut-off point
Chi-square	458.33	373.94	405.01	-
Model df	179	178	179	-
Df2/	2.56	2.10	2.26	Less than 3
GFI	0.893	0.913	0.906	0.90 <
AGFI	0.861	0.887	0.878	0.850 <
CFI	0.933	0.953	0.946	0.90 <
RMSEA	0.066	0.055	0.059	0.08 >

According to Table 3, the confirmatory factor analysis's fit index verifies the measurement model's adequate fit with the gathered data. The fit indices demonstrate a good fit between the measurement model and the collected data. The measurement model's most significant factor load belongs to the self-compassion indicator (β=0.94). It can be stated that in all paths, In the structural model of the study, it was assumed that self-compassion affects students' psychological flexibility through the mediation of sleep quality and psychological hardiness. The fit of the structural model was evaluated using the structural equation modeling method. As Table 3 shows, all fit indices supported the acceptable fit of the structural model with the collected data. Table 4 shows the path coefficients in the structural model.

Table 4

Direct, Indirect, and total path coefficients between variables

Predictor variables	b	SE	β	p
Self-compassion → sleep quality	-0.74	0.266	-0.67	0.011
Self-compassion → Psychological hardiness	0.976	0.168	0.94	0.003
Self-compassion → Psychological flexibility	0.110	0.117	0.06	0.157
Sleep quality → Psychological flexibility	0.045	0.073	0.01	0.945
Psychological hardiness → Psychological flexibility	0.504	0.050	0.47	0.001

Self-compassion and psychological flexibility have a positive and significant total path coefficient (sum of direct and indirect path coefficients), as seen in Table 4 (p<0.01, β=0.53). The direct path coefficient between

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self-compassion and sleep quality was negative and significant ($p<0.01$, $\beta=0.67$). The direct path coefficient between self-compassion and psychological flexibility was insignificant ($p<0.05$, $\beta=0.06$). The path coefficient between sleep quality and psychological flexibility was insignificant ($p<0.05$, $\beta=0.01$). The direct effect between psychological hardiness and psychological flexibility was positive and significant ($p<0.01$, $\beta=0.47$). Thus, it can be stated that the two mediating variables of sleep quality and psychological hardiness significantly mediate the effect of self-compassion on psychological flexibility.

Discussion and Conclusion

The present study develops a structural model of psychological flexibility based on self-compassion with the mediation of sleep quality and psychological hardiness. The results revealed that the two mediating variables of sleep quality and psychological hardiness significantly mediate the effect of self-compassion on psychological flexibility. These results are in line with the results of prior studies (Javadi & Ghorbani, 2019; Kramer et al., 2023; Mendes et al., 2023; Rusch et al., 2019; Tran et al., 2022). In explaining the results of the present study, it can be stated that the selective attention between people with good sleep quality and those with sleep problems is the only significant indicator of the incongruent mean. Daily tasks often include two tasks simultaneously (Abdollahi, 2015). Previous studies have confirmed this issue in sleep deprivation. They have shown that sleep deprivation significantly affects selective attention (Dennis & Vander Wal, 2010; Kim et al., 2020; Pinto et al., 2020). Rusch et al. (2019) induced forty hours of continuous insomnia in the subjects and measured their incongruent word and color performance using the Stroop test. They faced a reaction time higher than the mean, but when the color and the word were two completely different things, they met a mean reaction time. The cognitive flexibility of people in the morning, evening, and night hours was not significant in either the omission error or non-omission error (Rusch et al., 2019).

Previous studies confirmed that different day hours affect cognition (Pakenham et al., 2020). However, they have not explicitly examined whether cognitive flexibility and the selective attention of people are significantly different in the morning, evening, and night in the incongruent mean, congruent reaction time, and incongruent reaction time indices. The interaction effect between sleep quality problems and the circadian cycle in cognitive flexibility was significant in the omission error index. This result suggests that the circadian cycle at different hours significantly differs in two groups with and without sleep quality. In hours 7-9, 16-18, and 22-24, people with good sleep quality show different cognitive performance than people with sleep quality problems. For example, people with good sleep quality in the early morning hours had more cognitive flexibility than people with sleep quality problems. However, at night, the number of errors was higher for people with good sleep quality. Previous studies have confirmed that people differ in cognitive performance in the morning and night (Javadi & Ghorbani, 2019). The research literature review found no survey of the relationship between cognitive flexibility and sleep quality. Hence, in explaining this result, it can be stated that some subjects of this study who had sleep quality problems faced this situation for at least several years and were not very dissatisfied. Hence, we should not expect a fundamental difference between the subjects with good quality sleep in all areas. If we get used to a phenomenon, even unusual and abnormal, the severity of its psychological outcomes will be reduced. It can be stated that "accuracy" has complexity and difficulty in two cases: the incongruent and the neutral mean. It indicates that sleep quality affects selective attention when the accuracy problem is complex. In particular attention, We are looking for finding depth, and we are looking for expansion in cognitive flexibility. According to previous studies, deep thinking or deep performance depends on people's daily fatigue and vitality, which are different at different hours. Based on the results, when we face a quality of sleep that has become a permanent and stable pattern for people, we should not make a clear and definite distinction between them.

In explaining the relationship between self-compassion and sleep quality, it can be stated that people usually have problems with their sleep since they do not know where the source of their daily anxiety originates. Thus, eliminating or reducing the problem of people with sleep problems is crucial in improving the conditions of families, especially those who are more in contact with them. These results are consistent with some studies that confirm the existence of a relationship between

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compassion-based therapy and psychological health and the effectiveness of compassion therapy on psychological problems. Self-compassion allows people to have a non-judgmental view of themselves, be more tolerant of their difficulties and sufferings, and be more kind and patient. Thus, by accepting their painful experiences and giving up overestimating negative experiences, students are guided toward kindness based on the sense of shared humanity; they are allowed to see themselves and others. Accepting that pain and failure exist in all human beings, they can communicate with the present and themselves with awareness, enabling criticisms to pass through the mind without being proven wrong or believed. Accordingly, they should stop criticizing their mistakes regarding their current situation. Mindfulness increases a sense of kindness and compassion toward themselves, making them feel more loving and attached to themselves, thus enjoying better sleep quality.

The results also revealed a relationship between self-compassion and psychological hardiness. These results align with the results of other studies (Abdollahi, 2015). In this regard, Maddi (2015) suggested that hardiness encourages a kind of coping process that makes stressful events less traumatic, and this coping is called transformation. In other words, people with psychological hardiness are more likely to react to stressful events with increased interaction and make active efforts to find solutions. People with high levels of hardiness believe they can control or affect events. They also tend to interpret stressful events in a positive and structured way and view them as valuable challenges and opportunities for learning. Hardiness causes flexibility, reduces the threatening evaluation of events, and increases the person's efforts for successful adaptation. It also seems that hardiness as a source of internal resistance lowers the adverse effects of stress, increases people's kindness to themselves and attention to the present, and prevents physical and mental disorders (Maddi, 2015). Thus, hardiness makes the events to be evaluated positively and controllable, and this evaluation will cause the person not to get unfocused and confused in coping with problems, adopt more effective and appropriate coping strategies, and turn them into a positive experience. Thus, people with hardiness are more likely to evaluate stressful situations positively and have higher self-compassion due to the use of active and effective coping methods. The findings also showed a strong correlation between psychological flexibility and psychological hardiness. In explaining this relationship, it can be stated that flexible people do not avoid stress in their lives but consider stressful situations.

An opportunity for growth. The concept of flexibility means to return to the original state in such a way that when an object is elastic or bent.

As one's flexibility increases, one can consider difficult situations controllable, and when faced with life events and people's behavior, one can provide several alternative justifications. In difficult situations, they can find alternative solutions; thus, their capacity to cope, adapt, and recover from stress and difficulties increases (Taghizadeh, 2014). Based on cognitive flexibility theory, mental health means accepting one's internal and external environments and commitment to stable activities regarding value (Fazeli et al., 2015). Commitment is one of the structures of hardiness. A person who is committed considers life activities exciting and meaningful. Such a view reduces the intensity of the pressure of the events and helps the person to evaluate the situations as controllable, which increases the psychological flexibility in the person.

This study suffers some limitations, making it difficult to generalize its results. One of these limitations is the statistical sample. The present study was conducted only on students living in student dormitories, so its results cannot be generalized to other groups. Another limitation of this study is related to the gender and age of the participants. Studies suggest that adolescents are at risk of cognitive impairments caused by insufficient sleep.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this study.

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