



From Childhood Trauma to Non-Suicidal Self-Injury Behavior: The Roles of Negative Valence, Social Processes, and Cognitive Systems Based on the Research Domain Criteria Framework

Hossein Farrokhi¹, Imanollah Bigdeli², Ali Mashhadi², Seyed Ruhollah Hosseini²

¹Psychology Department, Khorasan Institute of Higher Education, Mashhad, Iran

²Department of Psychology, Faculty of Education and Psychology, Ferdowsi University of Mashhad, Mashhad, Iran

*Corresponding Author: Hossein Farrokhi, Email: hossein.farrokhi110@gmail.com

Abstract

Background: Non-suicidal self-injury (NSSI) is a serious and prevalent problem within the adult population. This cross-sectional study examined the moderating roles of negative valence, social processes, and cognitive systems in the relationship between childhood trauma (CT) and non-suicidal self-injury behavior (NSSI) based on Research Domain Criteria (RDoC).

Methods: The present study was conducted using a descriptive-analytical cross-sectional design.

Male young adults with a history of NSSI (N = 118), aged 18 to 30 years, who visited a medical clinic in Mashhad, Iran, between 2019 and 2021, participated in the study. Participants completed self-report measures including the Inventory of Statements About Self-injury (ISAS), Childhood Trauma Questionnaire (CTQ), Subjective Units of Distress Scale (SUDS), Anxiety Sensitivity Index (ASI-3), the Multidimensional Scale of Perceived Social Support (MSPSS), and the Barkley Deficits in Executive Functioning Scale (BDEFS). The collected data were analyzed using structural equation modeling (SEM).

Results: Participants reporting higher severity of NSSI also scored higher on measures of CT ($r = 0.51$, $P < 0.05$). Besides, executive dysfunction and perceived social support were shown to be associated with higher levels of all risk factors for NSSI and moderated the relationship between CT and NSSI. Moreover, executive dysfunction moderated the indirect effect of CT on NSSI through subjective units of distress. However, this effect was not moderated by anxiety sensitivity.

Conclusion: The findings from the present study suggested that childhood trauma had a significant positive effect on distress, anxiety sensitivity, and deficits in executive functioning, confirming the mediating role of social capital in the relationship between CT and NSSI.

Keywords: Non-suicidal self-injury behavior, Childhood trauma, Research domain criteria

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Introduction

Non-suicidal self-injury (NSSI) behaviors involve intentional injury to body tissue (such as cutting, burning, or hitting) without suicidal intent (1). These behaviors have garnered increasing clinical and research interest, leading to their inclusion as a condition requiring further study in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (2). Epidemiological studies estimate the lifetime prevalence of NSSI to range from 7.5% to 46.5% among adolescents, 38.9% among college students, and 4.0% to 23.0% among adults, with the typical age of onset between 12 and 14 years (3, 4). However, most research to date has focused on identifying NSSI risk factors, with limited studies exploring the occurrence and persistence of such risky behavior. Therefore, clinical

studies are required to understand the transition from early engagement to more sustainable patterns of NSSI (5).

The Research Domain Criteria (RDoC) framework offers a new model for elucidating NSSI risk factors by comprehensively investigating the developmental processes and transdiagnostic etiology of mental disorders in a matrix structured into six rows (domains) and seven columns (units of analysis) (6). Among these, three domains are used to explain self-injury behaviors: the systems for social processes, cognitive systems, and negative valence systems.

According to this transdiagnostic etiological model of mental disorders and most research findings, childhood trauma emerges as a significant factor in NSSI. Numerous



studies indicate that adverse childhood experiences, particularly abuse, serve as predictors of NSSI among adolescents and young adults. For instance, previous studies have shown a significant relationship between childhood sexual abuse and the development of NSSI (7,8,9,10). Furthermore, the parent-child relationships and social support are critically involved in the etiology of self-injurious behaviors. Poor parental attachment and emotionally neglectful parenting have been identified as strong predictors of NSSI in adulthood (11,12,13).

Along with social and parenting factors, cognitive processes such as executive functions are increasingly recognized as crucial in understanding normative processes. Responses to continuous neurological changes during puberty and brain development, especially in the frontal cortex, contribute to increased risk-taking behavior in young individuals, as these developments are critical in managing the performance of executive functions. In the same vein, results of several studies have demonstrated a significant relationship between executive function deficits and some high-risk behaviors, such as drug use, antisocial conduct, unsafe sex, and increased susceptibility to road accidents (14).

Previous research has also shown that emotion regulation, as a key component of the negative valence system, has an interactive relationship with executive functions and basic temperament traits in response to stress and anxiety. Recent theoretical studies have suggested that NSSI in young individuals may occur as a maladaptive coping mechanism in response to stress and anxiety, particularly in the context of cognitive impairment. The results reported by examining individual factors suggest that the frequency of NSSI is strongly predicted by deficits in emotion regulation, cognitive control, and heightened emotional reactivity, especially among men (5,9,10,15,16). Moreover, adolescence is associated with the relative stability of executive functions related to stressors compared to childhood (14). Non-suicidal self-injury, due to acute stress, especially among young individuals, exacerbates dysfunction and impairs emotion regulation (17,18,19,20,21). Heterogeneous diagnosis of such behaviors is common among other disorders in classification systems, and evidence-based intervention is one of the therapeutic challenges. Therefore, designing a model based on RDoC to identify transdiagnostic processes of this type of behavior offers a new perspective to improve this behavioral disorder and provide more effective strategies for health professionals (22,23).

The present study aimed to investigate the impact of childhood trauma on non-suicidal self-injury, considering the mediating roles of distress, anxiety sensitivity, perceived social support, and deficits in executive functioning – factors that have not yet been thoroughly studied among youth populations in Iran.

Methods

The present study was conducted using a descriptive-analytical cross-sectional design. A total of 118 young adult males, aged 18 to 30 years, participated in the study. Convenience sampling was used to recruit participants from patients who visited the psychiatry and neurology department of Imam Hossein Hospital, the psychology department of Ibn Sina Mental Hospital, and the psychology department of Valiasr Medical Clinic in Mashhad, Iran, between 2019 and 2021. Eligible participants were those young adults who had engaged in self-injury more than five times in the past year. Inclusion criteria were a primary DSM-5 diagnosis of NSSI, no current medication usage, age between 18 and 30 years, fluency in Persian, and the ability to participate in all assessment and treatment sessions. Exclusion criteria included the need for immediate medical treatment, having received a complete course of pharmacotherapy or psychotherapy within the past five years, presence of psychiatric disorders and substance abuse (excluding tobacco use), and a history of neurological conditions or brain surgery.

Participants completed self-report measures including the Inventory of Statements About Self-injury (ISAS) to measure NSSI, Childhood Trauma Questionnaire (CTQ), Subjective Units of Distress Scale (SUDS), Anxiety Sensitivity Index (ASI-3), the Multidimensional Scale of Perceived Social Support (MSPSS), and Barkley deficits in executive functioning scale (BDEFS).

Inventory of Statements About Self-injury (ISAS)

This scale was developed by Klonsky and Glenn to measure NSSI behaviors and functions by examining the frequency and performance of NSSI behaviors (including biting, burning, pounding, tattooing, wound picking, cutting, pinching, rubbing skin against rough surfaces, hair pulling, severe scratching, swallowing chemicals, and needle-sticking) in past year. This single-component scale ranges from a minimum score of 5 to an unlimited maximum. The scale's reliability, assessed via test-retest over 1-4 weeks, was reported as 0.85 (1). The internal consistency was also confirmed with a Cronbach's alpha of 0.84.

Childhood Trauma Questionnaire (CTQ)

This scale, developed by Bernstein et al comprises 28 items measuring five subscales, including physical neglect, emotional neglect, sexual abuse, physical abuse, and emotional abuse, rated on a 5-point Likert scale (never to always). Its reliability was reported as 0.94 using test-retest (24). The internal consistency was confirmed with a Cronbach's alpha of 0.79.

Subjective Units of Distress Scale (SUDS)

This self-assessment tool measures distress severity from

0 (no distress) to 10 (severe distress) (25). Its reliability in this study was 0.82.

Anxiety Sensitivity Index (ASI-3)

This self-report scale contains 18 items across three dimensions: physical anxiety, cognitive anxiety, and social anxiety. The scale exhibited high internal consistency, with Cronbach's alpha ranging from 0.80 to 0.90, and retest reliability coefficients of 0.75 after two weeks and 0.71 over three years (26). In this study, alpha was 0.78.

Multidimensional Scale of Perceived Social Support (MSPSS)

Designed by Zimet, Dahlem, Zimet, and Farley, MSPSS measures perceived social support with 65 items across three subscales of perceived support from friends, family, and significant others, rated on a 5-point Likert scale (27). The internal consistency in this study was 0.77.

Barkley Deficits in Executive Functioning Scale (BDEFS)

This is an 89-item self-report scale assessing executive dysfunction in non-clinical and clinical populations aged 18 to 81 years based on a 4-point Likert scale (never to always). The scale consists of five subscales, including self-management to time, self-organization/problem-solving, self-restraint, self-motivation, and self-regulation of emotion, with retest reliability coefficients as 0.84, 0.83, 0.90, 0.78, 0.62, and 0.78, respectively (28). The internal consistency in this study was 0.84.

The collected data in this study were analyzed using Anderson and Gerbing's structural equation modeling (SEM) via SPSS-23 and AMOS-22 (29). Accordingly, 118 random numbers were generated for six variables. The Kolmogorov-Smirnov test was applied to check normality ($P > 0.05$). Given the normal distribution of data, Pearson correlation, chi-square, and various fit indices - the comparative fit index (CFI), goodness of fit index (GFI), and Root Mean Square Error of Approximation (RMSEA) - were used to assess construct validity and collinearity.

Results

The participants in this study were 118 young adult males, aged 18 to 30 years (mean = 21.82, SD = 2.86). Most held a diploma (59.3%), with the remaining participants possessing other degrees. The majority of respondents (87.3%) were single, and their employment status showed that most were students (61%) or unemployed (28%) (Table 1).

Descriptive statistics presented in Table 2 showed that the mean childhood trauma score was 76.41, perceived social support was 20.26, executive functioning was 16.193, anxiety sensitivity was 51.86, mental distress was 63.39, deficit in executive functioning was 14.37, and self-injury was 5.60.

As shown in Table 3, the Pearson correlation test

Table 1. Demographic characteristics of young adult males with a history of NSSI (n = 180)

| Demographic Variable | Category | Frequency (N) | Percentage (%) |
|----------------------|-------------------|---------------|----------------|
| Mean age (SD) | | 21.82 (2.86) | |
| Marital Status | Single | 103 | 87.3 |
| | Married | 13 | 11 |
| | Divorced | 2 | 1.7 |
| Education Level | High School | 29 | 24.6 |
| | Diploma | 70 | 59.3 |
| | Bachelor's degree | 15 | 12.7 |
| | Master's degree | 4 | 3.4 |
| Employment Status | Unemployed | 33 | 28 |
| | Employed | 10 | 8.5 |
| | Student | 72 | 61 |
| | Homemaker | 3 | 2.5 |

revealed a significant relationship between childhood trauma ($r = 0.51$, $P < 0.05$), perceived social support ($r = -0.51$, $P < 0.05$), deficits in executive functioning ($r = 0.47$, $P < 0.05$), anxiety sensitivity ($r = 0.45$, $P < 0.05$), subjective units of distress ($r = 0.50$, $P < 0.05$), and NSSI as the dependent variable ($P < 0.05$). Based on the results, the correlation between perceived social support and NSSI was found to be negative ($r = -0.51$, $P < 0.05$). On the other hand, social support was positively correlated with self-injury and other self-injury variables. Moreover, the most significant correlation was between childhood trauma and self-injury ($r = 0.51$) and between perceived social support and self-injury ($r = -0.51$). In addition, childhood trauma exhibited significant relationships with all variables ($P < 0.05$).

Figure 1 depicts the adjusted experimental model after model refinement, with standardized coefficient values. In the initial model, several relationships were insignificant, and the model fit was not desirable. Therefore, the insignificant relationships were removed from the model, and the final model demonstrated a good fit. Accordingly, executive functioning sensitivity had the most significant effect on anxiety, with a standard coefficient of 0.33, and child trauma showed the strongest impact on mental distress, with a coefficient of 0.32.

The final model indicated an acceptable fit (CFI = .97, IFI = .97, GFI = .98, RMSEA = .098). None of the fit indices were weak, and the RMSEA index was moderate. All other indicators had an acceptable value, confirming the model fit. Besides, the coefficient of determination (R^2) for NSSI was 0.49, indicating that the independent and mediating variables of the model explain 49% of the variance in NSSI, supporting overall model fit ($\chi^2 = 2.12$).

Table 4 summarizes the direct, indirect, and total effects, as will be further elaborated:

1. Direct Effects: Direct positive relationships were observed among variables. For example, CTQ had

Table 2. Descriptive statistics for study measures among young adult males with a history of NSSI (n=180)

| Variables | Mean | Standard Deviation | Skewness | Kurtosis |
|-----------|--------|--------------------|----------|----------|
| CTQ | 76.41 | 13.12 | -0.89 | 0.19 |
| MSPSS | 20.26 | 6.38 | 0.23 | -1.13 |
| BDEFS | 193.10 | 95.66 | 0.78 | 1.02 |
| ASI | 51.86 | 9.74 | 0.47 | -1.16 |
| SUDS | 63.39 | 14.92 | -0.10 | -0.68 |
| NSSI | 5.60 | 2.39 | 0.63 | 0.04 |

CTQ: Childhood Trauma Questionnaire, MSPSS: Multidimensional Scale of Perceived Social Support, BDEFS: Barkley Deficits in Executive Functioning Scale, ASI: Anxiety Sensitivity Index, SUDS: Subjective Units of Distress Scale, NSSI: Non-suicidal self-injury

a direct positive effect on BDEFS, ASI, SUDS, and NSSI. BDEFS had a direct positive effect on ASI, SUDS, and NSSI. ASI and SUDS had direct positive effects on NSSI. Besides, MSPSS had a direct positive effect on NSSI. All these direct effects were statistically significant ($P < 0.05$).

- Indirect Effects:** Indirect effects represent the influence of one variable on another through one or more mediating variables. For instance, CTQ indirectly affected NSSI through BDEFS, ASI, and SUDS. These indirect effects were calculated by multiplying relevant standardized coefficients along each indirect pathway.
- Total Effects:** The total effect of a variable on another is the sum of its direct and indirect effects. For example, the total effect of CTQ on NSSI reflects the direct effect of CTQ on NSSI plus all indirect effects mediated by BDEFS, ASI, and SUDS.

As shown in Table 5, the mediating role of anxiety sensitivity in the relationship between childhood trauma and NSSI was not statistically significant ($P > 0.05$). However, mediation through executive functioning and mental distress in the relationship between childhood trauma and self-injury was confirmed as significant. Furthermore, the mediating roles of anxiety sensitivity and mental distress in the relationship between executive functioning and NSSI were confirmed ($P < 0.05$).

Discussion

The findings of this study indicated that adverse childhood experiences, as measured by CTQ, had both direct and indirect effects on NSSI through various mechanisms, such as deficits in executive functioning, experiential avoidance, and psychological distress. Childhood trauma was directly and significantly associated with increased NSSI. Moreover, perceived social support served as a protective factor with a significant negative relationship with NSSI. Besides, childhood trauma indirectly affected NSSI through pathways including decreased executive functioning and increased avoidance and distress. The proposed model explained 49% of the variance in NSSI,

Table 3. Pearson correlation coefficient between CTQ, MSPSS, BDEFS, ASI, SUDS, and NSSI

| Variables | CTQ | MSPSS | BDEFS | ASI | SUDS | NSSI |
|-----------|--------|--------|--------|--------|--------|------|
| CTQ | 1 | | | | | |
| MSPSS | **0.37 | 1 | | | | |
| BDEFS | **0.29 | **0.26 | 1 | | | |
| ASI | **0.32 | **0.25 | **0.39 | 1 | | |
| SUDS | **0.40 | **0.27 | **0.35 | **0.33 | 1 | |
| NSSI | **0.51 | **0.51 | **0.47 | **0.45 | **0.50 | 1 |

* $P < 0/05$ ** $P < 0/01$

CTQ: Childhood Trauma Questionnaire, MSPSS: Multidimensional Scale of Perceived Social Support, BDEFS: Barkley Deficits in Executive Functioning Scale, ASI: Anxiety Sensitivity Index, SUDS: Subjective Units of Distress Scale, NSSI: Non-suicidal self-injury

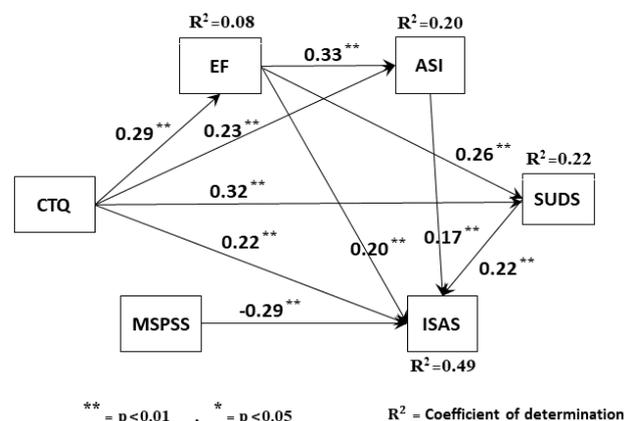


Figure 1. Structural model testing the moderating roles of negative valence, social processes, and cognitive systems in the relationship between childhood trauma and NSSI

demonstrating a high predictive power of the studied variables. These findings underscore the importance of early interventions aimed at reducing the impact of adverse childhood experiences and enhancing executive functioning and social support as protective factors against self-injurious behaviors.

The RDoC framework proves valuable in identifying the mechanisms underlying NSSI (29). This study evaluated the interaction of three RDoC domains (negative valence, social processes, and cognitive systems) in predicting NSSI among young individuals. Some studies suggest that self-injury may represent an extreme form of risk-seeking behaviors, particularly involving drug use, physical and sexual risk-seeking, and dysfunction in prefrontal brain regions responsible for impulse control and reward processing (14,19). In the same vein, neuroscientific studies support this perspective, indicating that individuals engaging in self-injury exhibit deficits in decision-making similar to those observed in risk-prone populations (23,30). Moreover, childhood abuse, which disrupts developmental trajectories and impairs early trust formation in children, has been identified as a fundamental risk factor for cognitive dysfunction and subsequent maladaptive coping. Children and

Table 4. The results of the test of structural relationships in the model (direct and indirect effects)

| Effects | Standardized coefficient | Unstandardized coefficient | SE | t | P |
|---------------|--------------------------|----------------------------|------|-------|-------|
| CTQ -->BDEFS | .290 | 2.117 | .645 | 3.28 | 0.001 |
| CTQ -->ASI | .230 | .170 | .064 | 2.66 | 0.008 |
| CTQ -->SUDS | .323 | .368 | .097 | 3.79 | 0.001 |
| CTQ -->NSSI | .221 | .039 | .014 | 2.78 | 0.005 |
| BDEFS-->ASI | .327 | .033 | .009 | 3.79 | 0.001 |
| BDEFS-->SUDS | .257 | .040 | .013 | 3.01 | 0.003 |
| BDEFS-->NSSI | .196 | .005 | .002 | 2.61 | 0.009 |
| ASI -->NSSI | .169 | .040 | .018 | 2.30 | 0.022 |
| SUDS -->NSSI | .218 | .034 | .012 | 2.92 | 0.003 |
| MSPSS -->NSSI | -0.287 | -0.105 | .026 | -4.05 | 0.001 |

CTQ: Childhood Trauma Questionnaire, MSPSS: Multidimensional Scale of Perceived Social Support, BDEFS: Barkley Deficits in Executive Functioning Scale, ASI: Anxiety Sensitivity Index, SUDS: Subjective Units of Distress Scale, NSSI: Non-suicidal self-injury

adolescents with histories of sexual and physical abuse or neglect often engage in NSSI to manage intrusive memories and emotional numbness, often leading to emotional dysregulation and cognitive impairment (1,4,7,11,15). Engagement in NSSI across developmental stages may exacerbate social conflicts, such as family or peer-related issues, which may serve as additional risk factors, especially during extended periods of youth. Although prospective studies remain scarce, existing evidence suggests a correlation between social support deficits and NSSI over short periods, emphasizing social conflict as a potential predictor of NSSI (13,31,32,33). Furthermore, interactions between social support and childhood trauma significantly influence the emergence of negative emotions, thereby increasing the risk of NSSI. However, recent theoretical studies have indicated that self-injurious thoughts and behaviors are more likely to result from failure to regulate acute stress (12). Recent advances in neuroscience have shown that adolescents experience neurological changes that increase their sensitivity to their social environment. These neurological changes may make adolescents vulnerable to social disturbances. In addition, these changes provide the basis for findings which indicate an increase in physiological responses to stressors and a lack of cognitive control in response to emotion-stimulating stimuli among adolescents (14,16,20,22). The transition to puberty is also associated with significant changes in peer relationships, including an increase in the number and frequency of peer interactions, as well as parent-child involvement (13).

The mediating role of executive function in the relationship between childhood trauma and emotion can predict NSSI. According to the result of the current study, the severity of NSSI in young individuals is related to cognitive executive dysfunction and less perceived social support. These results suggest that childhood

Table 5. Bootstrapping mediation analyses

| Path | Indirect effect | SE | t | P |
|---------------------|-----------------|------|------|------|
| CTQ -->EF -->ISAS | .058 | .022 | 2.64 | .009 |
| CTQ -->ASI -->ISAS | .039 | .022 | 1.78 | .078 |
| CTQ -->SUDS -->ISAS | .070 | .024 | 2.93 | .004 |
| EF -->ASI -->ISAS | .056 | .019 | 2.95 | .004 |

trauma, through defects in the negative and cognitive valence systems, may affect the onset or maintenance of NSSI. A combination of community and family stress (e.g., childhood trauma) and cognitive vulnerabilities (e.g., inhibition) also predicted NSSI. These findings are well-supported and imply that young individuals experiencing childhood trauma and social conflict are more likely to engage in NSSI when they exhibit higher baseline levels of executive dysfunction. Although several psychological and behavioral models of NSSI have gained considerable attention in recent years, the advancement of transdiagnostic models of this behavior should also be considered. Advances in this area are necessary for discovering crucial pathways in developing NSSI, particularly in new research domains. Therefore, further research is required to investigate the main processes of NSSI risk factors to stabilize this type of behavior during development. Identifying change processes during the developmental stages of chronic NSSI development may facilitate the recognition of modifiable goals for intervention. Moreover, specifying risk factors (e.g., gender and a history of NSSI) is essential to identify those at risk. Nevertheless, there is still little understanding of why these individuals engage in NSSI at a young age, why this behavior persists, or what the optimal timing for intervention might be (17). Thus, the interaction between cognitive dysfunction and lower social support in youth may increase susceptibility to stressors and the likelihood of developing NSSI.

This study had limitations, including a limited time frame, non-cooperation of some participants in completing the questionnaires accurately, a small sample size, and the lack of access to certain participants for data collection.

Conclusion

This study examined NSSI as a potential response to childhood trauma, especially among young individuals with deficits in cognitive and emotional regulation and limited social support. The findings indicated that young individuals experiencing heightened negative valence system activity, cognitive deficits, and social conflicts exhibited more NSSI behaviors. It was also revealed that all three negative valence, social processes, and cognitive systems were correlated with NSSI behaviors. Notably, the cognitive system interaction as a mediating variable could mediate the effect of childhood trauma on the

negative valence system, ultimately impacting the severity and persistence of NSSI behaviors in youth. Moreover, the findings supported a transdiagnostic model grounded in the Research Domain Criteria (RDoC) framework for self-injury behaviors, highlighting the interaction between negative valence, social processes, and cognitive systems in predicting at least some types of NSSI among young individuals. The interaction of cognitive and social factors increased the perception of emotional factors and childhood experiences, thereby predicting NSSI among young individuals. Finally, clinical results revealed that enhancing social relationships, strengthening social support systems, and improving neurological and cognitive functions, especially among young individuals, may serve as protective factors against the onset of self-injurious behaviors, which often persist during adulthood.

Authors' Contribution

Conceptualization: Hossein Farrokhi, Imanollah Bigdeli.

Data curation: Hossein Farrokhi.

Formal analysis: Hossein Farrokhi.

Investigation: Hossein Farrokhi.

Methodology: Hossein Farrokhi, Imanollah Bigdeli, Ali Mashhadi, Seyed Ruhollah Hosseini.

Project administration: Hossein Farrokhi, Imanollah Bigdeli, Ali Mashhadi, Seyed Ruhollah Hosseini.

Supervision: Imanollah Bigdeli, Ali Mashhadi, Seyed Ruhollah Hosseini.

Validation: Imanollah Bigdeli, Ali Mashhadi, Seyed Ruhollah Hosseini.

Competing Interests

The authors declare that they have no conflicts of interest.

Ethical Approval

Participants received detailed explanations about the objectives and procedures of the study. They were also assured that all information would remain strictly confidential and anonymous, and that participation was voluntary with the option to withdraw at any time. The protocol for this study was approved by the Ethics Committee in Bioresearch of Ferdowsi University of Mashhad with the code of ethics IR.UM.REC.1400.033.

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