Research Paper

Investigating the Moderating Role of Cognitive Flexibility in the Relationship Between Maltreatment and Emotion Regulation in Adolescence With Childhood Trauma

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ABSTRACT

Background: Adolescence is a developmental period when adverse childhood experiences significantly impact the individual because of the changes in brain structure and functioning. This research aims to investigate the relationship between maltreatment and emotion regulation with the moderating role of cognitive flexibility in adolescence with childhood trauma.

Methods: This was a descriptive-correlational study. The study population consisted of all adolescents who were referred to the psychological and psychiatric disorders clinics and medical clinics of Shiraz City, Iran, in the spring semester of 2021. The population included 250 individuals, of which 175 were selected as the sample of the research via the simple random sampling method according to the Morgan Table. The research tools were the childhood trauma questionnaire, the cognitive flexibility questionnaire, the psychological maltreatment scale, and the emotional regulation scale. After completing the questionnaires, the data were entered into the SPSS software, version 23, and analyzed using descriptive and inferential statistics. The Pearson correlation test and the regression method were used to analyze the data.

Results: The results showed a significant negative correlation between maltreatment with emotion regulation ($r=-0.531$, $P<0.001$). The results showed that the interaction of these 3 variables indicated that cognitive flexibility has a moderating role in the relationship between maltreatment and emotional regulation ($\beta=-0.90$, $P<0.01$). Moreover, the results indicated that the relationship between maltreatment and emotion regulation in adolescence with high flexibility is higher than in individuals with low flexibility.

Conclusion: This study provides evidence that cognitive flexibility can act as a moderator when considering the impact of trauma. The developed task could provide a novel way to assess this flexibility within an emotional context.

Keywords: Cognitive flexibility, Maltreatment, Emotion regulation, Childhood trauma, Adolescence

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1. Introduction

Early years of brain development are especially susceptible to toxic stress caused by adverse childhood experiences. A child's brain can be physically changed by toxic stress and the effects can be hardwired into the child's biology via genes, according to epigenetic research [1]. As a result of the compelling connection between early adversity and the later health and development of the subject, there has been renewed interest in protecting against the impact of early adversity [2]. An environment that allows the child to play, explore, and maximize their capabilities is an example of how individual protective factors can be enhanced. Building the child's self-efficacy and self-regulation are key attributes of resiliency, and early childhood educators can support their development [3].

Childhood maltreatment can have a long-term negative impact on mental health, psychopathology, and interpersonal relationships, making it a particularly damaging early life stressor. The risk of depression increases after experiencing childhood maltreatment, particularly a stressful life event. The emotional regulation strategies employed in childhood can mitigate the effects of childhood maltreatment on depression later in life [4]. As a result of the high co-occurrence of maltreatment types, research has shifted from studying single types of maltreatment to examining the effects of multiple types of this issue on children's functioning in the last decade [5, 6]. The results of a recent study [7] on maltreated and non-maltreated children showed that 57% of maltreated children experienced multiple types of maltreatment (physical, sexual, emotional abuse, and neglect). Several studies have suggested that positive relational experiences, such as responsive caregiving, may enhance children's cognitive flexibility [8, 9].

An individual's ability to bounce back from adversity demands the ability to adjust to changing circumstances [10]. To cope with stressful events, coping strategies need to be flexible and adaptable according to changing contextual factors. As part of flexibility, cognitive flexibility is also important. Despite being multifaceted, cognitive flexibility exhibits traits as well as state characteristics, making it a critical component of executive function. It is difficult to define cognitive flexibility; however, some definitions describe it as the ability to change rules or modes of thinking extemporaneously [11]. The results indicated that the degree of stress was positively correlated with indices of psychological maladjustment, while cognitive flexibility was negatively associated with psychological symptoms. Furthermore, cognitive flexibility demonstrated a significant moderating effect on the relationship between stress and psychological symptoms. Such results suggest that cognitive flexibility may serve as a protective factor in the potential effects of stress on psychological adjustment. Implications and suggestions for future research are discussed [12]. Moreover, Yu et al. demonstrated that greater scores of anxiety and depression were associated with lower scores of cognitive flexibility and higher levels of impulsivity. Depression and cognitive flexibility could predict attention impulsivity and non-planning impulsivity, while anxiety and cognitive flexibility could predict motor impulsivity. Cognitive flexibility served as a mediator in the links between anxiety and the 3 subscales of impulsivity. Furthermore, cognitive flexibility moderated the impact of anxiety on motor impulsivity [13]. According to Amédée et al. (2022), strengthening emotional regulation competencies in children in residential care may prevent further maladaptive behavior when focusing on cognitive flexibility [14].

In a previous study, researchers found that cognitive flexibility partially mediated the correlation between childhood abuse experiences and substance abuse tendencies in all sub-dimensions of childhood abuse. It is estimated that cognitive flexibility mediates between 13% and 23% of the total impact of childhood traumatic experiences on substance abuse tendencies. Based on a mediated variable analysis, cognitive flexibility partially mediated the relationship between childhood abuse experiences and substance abuse tendencies [15]. Previous findings indicate that individuals with a history of childhood maltreatment may highly use maladaptive emotion strategies to cope with these problematic childhood memories because of a lack of emotion regulation skills, subsequently engaging in visible maladaptive behaviors, such as high alcohol craving, alcohol use, and alcohol dependence as coping strategies to overcome childhood maltreatment-related problems and failure to regulate maltreatment-related distressing experiences cognitively [13, 15].

A brief overview of the literature suggests that exposure to childhood trauma increases sensitivity to environmental stressors. Additionally, individuals exposed to childhood trauma are more likely to appraise environmental stressors as threatening. Finally, cognitive flexibility may allow individuals to respond more adaptively to environmental stressors. Since exposure to childhood trauma enhances the probability of developing problematic childhood memories because of a lack of emotion regulation skills and subsequently engaging in visible maladaptive behaviors [13, 14], our primary aim is to examine the relationship between maltreatment and emo-

tion regulation. Since the moderating role of cognitive flexibility is less studied and deficits in cognitive flexibility are associated with maladaptive behaviors [14, 15], this study also investigates the role of cognitive flexibility as a moderator in the relationship between maltreatment and emotion regulation in adolescence with childhood trauma.

Because the moderating role of cognitive flexibility is less studied and deficits in cognitive flexibility are associated with maladaptive behaviors [14, 16], this study also investigated the role of cognitive flexibility as a moderator in the relationship between maltreatment and emotion regulation in adolescence with childhood trauma. The conceptual model of the research is shown in Figure 1.

2. Methods

This was a descriptive-correlational study. The population consisted of all adolescents who were referred to the psychological and psychiatric disorders clinics and medical clinics of Shiraz City, Iran, in the spring semester of 2021. The study population included 250 individuals, of which 175 were selected as the sample of the research via simple random sampling according to the Morgan table. In these centers, relevant physicians, psychologists, counselors, and social workers explained the study criteria and introduced the perfect candidates for the study purposes, with all of them agreeing to participate in the research. Finally, the researchers conducted clinical interviews to ensure having relevant experience of traumatic events and met the study criteria of the participants. The inclusion criteria comprised the following items: 1) having 12 to 18 years of age, 2) having consent to participate in the research, and 3) having a history of exposure to a traumatic event according to the criteria in the childhood trauma questionnaire. Out of the 175 initial participants, 15 individuals were excluded because of providing incomplete data. The study (including a survey of participants with questionnaires) was conducted by clinical psychologists, under the supervision of their professors. The aim of the study was explained to all participants and an informed consent letter was obtained from all participants before participating in the study. The students were first informed about the confidentiality of the information and then completed the questionnaires. All participants responded to the questions with satisfaction and were assured that the data would be analyzed generally. It was not necessary to write the name and surname and participation in the study was voluntary. After completing the questionnaires, the data were entered into the SPSS software, version 23, and analyzed via descriptive and inferential statistics. The Pearson correlation test and the regression method were used to analyze the gathered data. In this study, the Persian version of the questionnaires was used, with their psychometric characteristics reviewed and approved in Iran. The P value of less than 0.05 was considered statistically significant.

Research Tools

Childhood trauma questionnaire

Bernstein et al. (2003) developed the Childhood Trauma Questionnaire (CTQ). It is a 25-item questionnaire that evaluates the experience of various types of childhood trauma [17]. The questionnaire includes 5 subscales, namely abuse (physical, emotional, and sexual) and neglect (emotional and physical). Items are valued from 1 to 5 (never true=1 and very often true=5). The reliability, divergent, predictive, and convergent validity

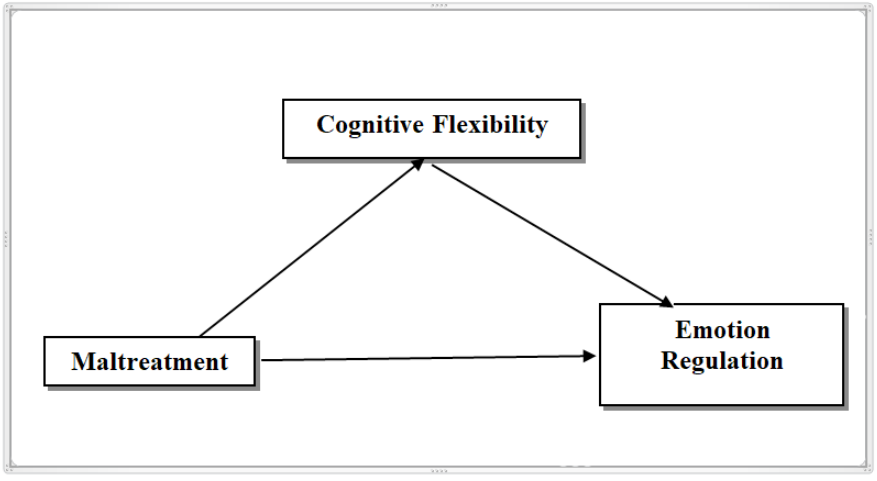

Figure 1. Conceptual model of research

of CTQ has been verified in both subclinical and clinical populations and are reported to be in an excellent situation [17]. In this study, the Persian version of CTQ was administered and the internal consistency was reported in the range from good to excellent for each subscale with an α coefficient for each scale (emotional neglect α=0.91, physical neglect α=0.77, emotional abuse α=0.89, physical abuse α=0.93, sexual abuse α=0.87 [18]).

Cognitive flexibility questionnaire

The cognitive flexibility questionnaire (CFQ) was developed by Dennis and Vendera [19]. CFQ is a 20-question self-reporting tool and is used to measure the kind of cognitive flexibility needed to successfully challenge one's ability to replace dysfunctional thoughts with more efficient ones. The scoring method is based on a 7-point Likert scale from 1 to 7. CFQ aims to measure the 3 aspects of cognitive flexibility, namely 1) the desire to understand difficult situations as controllable situations, 2) the ability to create several alternative justifications for human life events and behavior, and 3) the ability to create several alternative solutions for difficult situations [19]. The concurrent validity of this questionnaire is equal to the validity of the Beck questionnaire (BDI-II) which was obtained at -0.39. Martin and Anderson tested the reliability of the tool via the Cronbach α method for the whole scale, including the control ability related to the perception of different options, which was obtained at 0.91, 0.91, and 0.84 [20]. The value was obtained by the retrieval method, which equaled 0.81, 0.75, and 0.77, respectively. The coefficient of validity of the whole scale by the retest method was reported at 0.71 by Shareh et al. in Iran [21]. The subscales that reported on the controllability perceptions, perceptions of different options, and behavior justification perceptions were 0.87, 0.89, and 0.55, respectively. In this study, the questionnaire obtained a reliability coefficient of 0.68, measured by the Cronbach α method.

Psychological maltreatment scale

The psychological maltreatment scale (AMI-24) is a self-reporting instrument with 24 retrospective items related to past stressful misbehavior events. This tool was created by Kutz et al. in 1993 [22]. Initially, AMI-24 had 11 items, however, it has been reduced to 1 main factor. The mentioned factors include emotional unresponsiveness, rejection/intimidation, unethical/dishonest, high expectations/inflexibility, and isolation. The respondents answer the questions in a range from 7 (completely disagree) to 1 (completely agree). The internal consistency coefficient for the current scale was in the range of 0.80 to 0.83 among 20 students. In the research by Kutz et al., the internal consistency coefficient was 0.87 for the emotional unresponsiveness scale, 0.90 for the rejection/intimidation scale, 0.19 for the unethical/dishonest scale, and 0.10 for the high expectations/inflexible scale. The Cronbach α of this questionnaire was obtained at 0.98 in the research by Mohammadpour, Nazari, and Farhadi [23]. To determine the construct validity of this tool, we used the method of exploratory factor analysis via the method of principal components with varimax rotation. Before implementing this method, the Kaiser-Meyer-Olkin test was used to test the adequacy of sampling, and the value of this index was acceptable (0.11). The Bartlett sphericity test was also significant (0.009) [23]. Factors were determined based on eigenvalues and scree diagrams which finally showed 5 factors according to the original scale. This structure could explain more than 32% of the variance of the entire scale. Also, in this research, the Cronbach α coefficient for each of the subscales was obtained in the range of 0.32 to 0.99, namely acceptable to excellent. The reliability of the questionnaire in this study was obtained at 0.78 based on the Cronbach α method.

Emotion regulation scale

The emotion regulation scale was made by Gross and John [24]. This scale consists of 10 items, involving reassessment subscales (6 items) and subdue (4 items). The answers are scored based on a Likert scale (7 degrees) ranging from 1 (totally disagree) to 7 (totally agree). The Cronbach α coefficient for the reevaluation was 0.79 and 0.73 for the subscale. The retest reliability after 3 months, for the whole scale, was 0.68 23. The Milan State University Staff and Catholic students obtained the intrinsic homogeneity coefficient of this scale for the reassessment on a scale of 0.48 to 0.68 and subsidence of 0.42 to 0.63. The correlation coefficient of reappraisal with a positive effect scale was 0.24, and a negative effect of - 0.14 was also reported. The Persian version of the Gross and John questionnaire has been standardized by Hasani [25]. In this study, the validity of the scale is based on the internal consistency method (the Cronbach α ranged from 0.60 to 0.81).

3. Results

The age of the participants ranged from 12 to 18 years (Mean±SD=15.46±0.74). The study revealed that the lowest age group in the sample was 12 to 15 years of age with 64(37%) people and 111(63%) people in the age range of 16 to 18 years. As part of the selection process, 86(49%) subjects of the statistical sample were boys and

89(51%) were girls. Of the 90 participants, 51.42% were unemployed and addicted to drugs, 30(17.14%) had a university education, and the rest were either illiterate or had little to no education. It should be noted that 70% of the participants in the study had at least two suicides on their record. Table 1 shows the mean and standard deviation of the variables.

According to Table 2, the kurtosis coefficient (and skewness coefficient) for all scales and subscales scores was obtained. Table 2 shows that, according to the normality criteria, the research variables have an absolute value of the skewness coefficient smaller than 3 and an absolute value of the skewness coefficient smaller than 10; therefore, no violation regarding the normality of the data can be observed. Among the variables, the coefficient of kurtosis and skewness for cognitive flexibility does not have the default of normality.

As can be seen in Table 3, the tolerance statistics along with the inflation factor of variance, are (0.759 and 318.18) for emotion regulation, (0.699 and 1.430) for maltreatment, and (0.960 and 1.041) for cognitive flexibility. The contents of Table 3 show that the tolerance values for the variables are over 0.10, indicating the absence of multicollinearity between the variables. Also, the amount of variance inflation factor for variables is smaller than 10, indicating no multicollinearity between variables. Moreover, according to the findings, a significant negative correlation exists between maltreatment, emotional neglect, incuriosity, and emotion regulation at the significance level of $P<0.001$ ($r=-0.531$).

Table 1. Descriptive statistics

Variables	Mean±SD	Minimum	Maximum
Emotion regulation	21.82±5.84	3	43
Maltreatment	94.06±12.58	24	120
Emotional neglect	45.14±3.29	12	60
Incuriosity	41.96±3.11	12	60
Cognitive flexibility	64.38±9.81	20	138
Perception of controllability	29.13±2.36	6	42
Perception of different options	27.45±2.73	6	40
Understanding the justification of behavior	36.19±3.82	8	54

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Table 2. Results of the normality test of research variables

Variables	Kurtosis	SD of Kurtosis	Skewness	SD of Skewness
Emotion regulation	2.273	0.251	12.811	0.498
Maltreatment	1.612	0.251	2.389	0.498
Emotional neglect	1.529	0.251	2.208	0.498
Incuriosity	1.617	0.251	2.427	0.498
Cognitive flexibility	0.559	0.251	0.302	0.498
Perception of controllability	0.511	0.251	0.312	0.498
Perception of different options	0.574	0.251	0.294	0.498
Understanding the justification of behavior	0.548	0.251	0.306	0.498

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Table 3. Results of multicollinearity analysis of research variables

Variables	Indicators of Multicollinearity	
	Tolerance	VIF
Emotion regulation	0.960	1.041
Maltreatment	0.635	1.575
Emotional neglect	0.717	1.377
Incuriosity	0.564	1.720
Cognitive flexibility	0.615	1.627
Perception of controllability	0.682	1.578
Perception of different options	0.597	1.719
Understanding the justification of behavior	0.626	1.623

VIF: Variance inflation factor.

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According to Table 4, the interaction of maltreatment and cognitive flexibility has increased the amount of variance explained by the variable of the criterion (0.33 to 0.37). The regression coefficients related to the interaction of these 3 variables, indicated a statistically significant increase. In addition, cognitive flexibility has a moderating role in the relationship between maltreatment and emotional regulation (β=-0.90, P<0.01).

4. Discussion

This research aimed to investigate the relationship between maltreatment and emotion regulation with the moderating role of cognitive flexibility in adolescence with childhood trauma. The results of the study showed a significant negative correlation between maltreatment with emotion regulation in adolescence with childhood trauma. This finding is in line with several previous studies [4, 7, 26-28].

To prevent child maltreatment from resulting in adverse mental and physical health problems, it is crucial to identify risk factors and resilience processes involved in the process. A person's ability to cope and regulate emotions may buffer against pre-existing risks, while deficits in these processes could exacerbate the situation. As a result, the way previously-maltreated youth respond to stress throughout their development course may explain the association between abuse and neglect in early life and later maladjustment. According to findings, maltreatment is broadly associated with poor emotion regulation, emotional suppression, and negative emotional expression in response to stress [26]. A structural model has shown that psychological maltreatment

Table 4. Results of Moderator regression analysis related to the interactive relationship between maltreatment and emotion regulation with cognitive flexibility

Predictor Variables	MR	RS	F	P	R		
					1	2	3
Maltreatment	0.53	0.28	35.281	<0.001	β=0.531 t=5.940 P<0.001		
Cognitive flexibility	0.58	0.33	22.688	<0.001	β=0.522 t=6.052 P<0.001	β=0.237 t=2.745 P<0.007	
Maltreatment× cognitive flexibility	0.61	0.37	17.821	<0.001	β=1.118 t=4.245 P<0.001	β=0.870 t=3.126 P<0.002	β=-0.906 t =-2.386 P<0.01

MR: Moderator regression;

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negatively predicts social connectedness and social acceptance, however, it does not significantly predict subjective well-being among the youth [29]. To explain the results, the cumulative risk models suggest that adolescents who are exposed to stress during adolescence may have mental health problems if they were maltreated as children, including sexual abuse, physical abuse, emotional abuse, physical neglect, and emotional neglect [30]. Since stressful experiences cannot be completely avoided to prevent maladjustment, how individuals respond to stress plays an integral role, as it has the potential to either counteract or amplify the risk of maladjustment [26, 31]. It has also been shown that emotion regulation problems and the use of specific maladaptive emotion regulation strategies are associated with concurrent and prospective internalization of psychopathology. The concurrent and prospective associations of anxiety and depression in adolescence with childhood trauma are mediated by rumination [28].

Adolescents with high flexibility have a stronger relationship between maltreatment and emotion regulation compared to adolescents with low flexibility. Earlier research has shown that maltreatment is associated with poor automatic emotion regulation. Our study indicates that threatening events specifically interfere with inhibition in emotional contexts, but not in non-emotional contexts [32]. The results of the analysis found evidence of a positive significant correlation between all sub-dimensions of childhood traumatic experiences and substance abuse proclivity and negative significant correlations between all sub-dimensions of childhood abuse experiences and substance abuse tendency with cognitive flexibility [14].

Our data indicate that experience with early life trauma adversity in the form of maltreatment is associated with increased higher anxiety levels for the individual. In contrast, childhood maltreatment is associated with reduced flexibility in appraising challenges, which mediates the relationship between maltreatment and anxiety [12]. The tested model showed the mediating effect of emotional schemas and psychological inflexibility on the relationship between childhood maltreatment and emotional distress. Increased childhood maltreatment was associated with increased negative beliefs about emotion and psychological inflexibility, which determines emotional distress [33, 34]. Moderation analyses showed that the effect of child maltreatment on emotion regulation was only present for children with high levels of cognitive flexibility, such that as children experienced lower levels of severe maltreatment, they showed emotion regulation competencies more. Children with low cognitive flexibility displayed lower levels of emotion regulation regardless of their maltreatment history. These results suggest that focusing on cognitive flexibility when intervening with children in residential care could help strengthen their emotion regulation competencies, which may prevent further maladaptive behaviors [13]. These results should be considered preliminary.

Study limitations

Several limitations justify the caution required when interpreting the results, such as the small sample size. There is some evidence to suggest that behavioral and self-report measures provide insight into different aspects of cognitive flexibility. Also, this was a cross-sectional study; therefore, causal inferences cannot be drawn. Meanwhile, childhood traumas, including complex traumas, and other adverse childhood experiences that might have contributed to emotional difficulties were not assessed. Participants may have undergone psychotherapy for related issues. The COVID-19 pandemic may also have adverse effects on the mental health of participants. Findings will be more generalizable if similar studies are conducted on individuals who suffer from depression and anxiety. Studying qualitative factors associated with childhood maltreatment, such as in-depth interviews with clinical samples, will enhance our understanding of mental health problems associated with childhood maltreatment.

5. Conclusion

A negative and significant correlation was observed between childhood trauma and emotion regulation, while cognitive flexibility moderated this relationship in adolescence with childhood trauma. From this finding, it can be concluded that the early development period and family member treatment, relationships, and health are the key factors in predicting later life emotional and cognitive growth and function. This study presents evidence that cognitive flexibility may be a moderator when considering the impact of trauma. The developed task could provide a novel way to assess this flexibility within an emotional context. The participants with more maltreatment experiences have more problems in emotion regulation. This study focuses on several practical implications, including the importance of the relationship between maltreatment experiences with emotional regulation in adolescence with childhood trauma. This can increase the awareness of experts in this field about the consequences of maltreatment. In addition, researchers and therapists in this field will consider maltreatment a risk factor for the defect in regulating emotions and mental disorders.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles were considered in this article. This study has been approved by the Ethics Committee of Shiraz University of Medical Sciences (Code of Ethics: IR.SUMS.REC.1400.026).

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Authors' contributions

All authors contributed equally to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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