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Mediating Role of Cognitive Flexibility in Predicting the relationship between Childhood Traumatic experiences and Substance Abuse Tendency among Adolescent Females

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Abstract

Background: Drug abuse is a major issue and one of the main causes of health, psychological, and social problems. The present study aimed to investigate the mediating role of cognitive flexibility in predicting the relationship between childhood traumatic experiences and the tendency to abuse addictive substances among adolescent females in Yazd, Iran, in the academic year 2022-23.

Objectives: The present study aimed to investigate the mediating role of cognitive flexibility in predicting the relationship between childhood traumatic experiences and the tendency to abuse addictive substances among adolescent females in Yazd, Iran, in the academic year 2022-23.

Methods: The research method is correlated. The study's statistical population included all female high school students in Yazd, Iran for the academic year 2022-23. A sample of 200 adolescent girls (ages 13-15) was recruited using multistage sampling. Participants had at least one self-injurious behavior in their medical records. Cognitive Flexibility Inventory-Iranian Version, Adverse Experiences in Childhood Relationships, and Readiness Scale for Substance Abuse were completed. SPSS software (version 23) was sued to analyze data paths and standard coefficients.

Results: The obtained results indicated a significant relationship between all correlation coefficients obtained between a tendency to abuse addictive substances, traumatic experiences in childhood, and cognitive flexibility at the P<0.01 level. In addition, the indirect effect of cognitive flexibility on the tendency to abuse drugs was significant, and the proposed model was confirmed.

Conclusion: As evidenced by the results of this study, cognitive flexibility was associated with childhood traumatic experiences and the tendency to abuse addictive substances. In addition, cognitive flexibility mediates the relationship between childhood traumatic experiences and the tendency to abuse addictive substances among adolescent females.

Keywords: Adolescent females, Addictive Substances, Childhood Traumatic experiences, Cognitive Flexibility, Tendency to Abuse

1. Background

Early experiences that cause negative effects on cognition and behavior may persist beyond childhood, such as abandonment or abuse (1). According to research, early exposure to stress causes lower self-esteem (2), aggressive behavior (3), and suicidal ideation (4). A significant increase in psychiatric disorders, such as anxiety, substance abuse, and personality disorders, was observed in adults who were experiencing both mental health issues (5,6). The World Health Organization (WHO) defines child abuse (CA) as any interaction that causes harm and is primarily controlled by strong or trusted parents or guardians (7). In addition, family-school communication during adolescence has long-term protective effects on adult health, including mental health, violence, sexual behavior, and substance use (8). During adolescence, greater happiness is associated with more life satisfaction and hope, as well as less perceived stress (9). Finally, positive affect during adolescence predicts adult life satisfaction (10).

Research shows that the amygdala, which plays a role in our emotions, is influenced by our early life experiences and may develop differently as a result. The amygdala, which helps us notice danger, is more active when a child is being abused at home (11). Over time, this leads to continued amygdala involvement, even in non-stressful environments (12). For example, neuroimaging (i.e. fMRI) research has shown that children who have witnessed domestic violence have a more active amygdala than children who have not been abused. However, the ability to respond to environmental threats while dealing with ongoing mission requirements is adaptability, as is the ability to be exposed to maladaptive attention and processing behavior. Emotions in the face of threatening environmental stimuli. The inability to respond to the flexible demands of the environment has been linked to a wide range of psychological disorders such as anxiety (13). However, recent results from experimental studies have provided consistent evidence of persistent deficits associated with ELS in several cognitive domains, with preliminary suggestions that associated changes in ELS involvement in latent and skill-based learning may account for reward as well as cognitive flexibility (6). However, significant individual variation in the long-term adverse effects of ELS has been reported, to the extent that even after severe ELS some individuals show no cognitive impairment or high psychological burden (14).

Different models have been applied to conceptualize ELS and understand the neurobiological mechanisms through which stress affects development (1-5). Childhood adversity and stress have been conceptualized in different ways over the years (8,9); nonetheless, the two dominant models of the phenomenon are (1) general or clip models, of which there are many types. A stressor is typically described as a heterogeneous and broad category, such as a "problem," "early life stressor," or a "negative life event" (1,5,6,13,14). In models of specific or "distributive" adversity, each type of adversity has its effects, and heterogeneous samples can obscure links between them and neurobiological systems (3,5,15). In particular, functional brain networks responsible for cognitive and sensorimotor control explain the relationship between childhood trauma and predict future high-risk behavior. These findings are relevant for the prognosis of drug use disorders (16).

Early life stress impairs cognitive flexibility, which acts as a protective factor against the development of rigid maladaptive behaviors. It is worth noting that the association between ELS and habitual behavior is fully mediated by cognitive flexibility, suggesting that diminished cognitive flexibility associated with ELS promotes habitual behavior (6). Analysis of the data points to a significant positive correlation between childhood traumatic experiences and substance abuse on all sub-dimensions. Based on the mediation test results, cognitive flexibility was identified as a partial mediator of the connection between childhood abuse experiences and substance abuse tendencies (17). To address this issue, the current study examined a mediation model to determine the relationships between childhood trauma, cognitive flexibility, and substance abuse among adolescent girls (Figure 1). As a potential mediator, cognitive flexibility can moderate the impact of childhood trauma on individual variations in a tendency to abuse addictive substances. Even though cognitive flexibility has recently received increased attention regarding its role in goal-oriented behavior and mental illness, factors contributing to individual differences have not been fully explored.

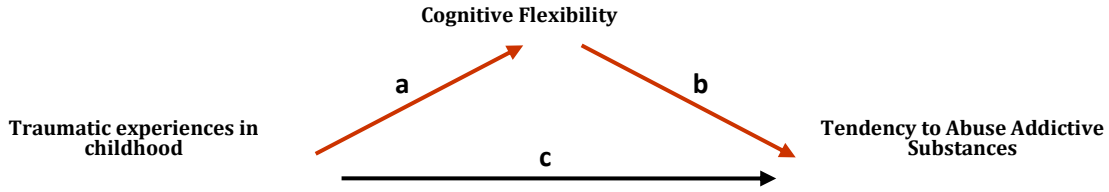

Figure 1. Conceptual framework of the research

2. Objectives

The present study aimed to investigate the mediating role of cognitive flexibility in predicting the relationship between traumatic childhood experiences and substance abuse tendencies in adolescent girls in Yazd, Iran, throughout the 2022-23 school year.

3. Methods

The present study was conducted based on a cross-sectional design. The statistical population of the research included all female students of the first secondary level of Yazd in the academic year 2022-2023. A sample of 200 adolescent females (13-15 years old) was selected via multi-stage sampling. The sample size based on Cochran's formula was 220 cases. In structural equation studies, the sample size typically ranges from 15-20 subjects per path, and the overall sample should include more than 200 cases. A total of 250 subjects was deemed sufficient to test the proposed model and research hypotheses. Nonetheless, to account for potential sample loss, a total of 220 individuals were selected using the convenience sampling method. After removing incomplete questionnaires, the final sample size consisted of 200 participants.

The inclusion criteria entailed 1) willingness to take part in the study, 2) provision of informed consent, and 3) complete, correct, and accurate questionnaires. On the other hand, the exclusion criteria were 1) unwillingness to participate in the research, 2) incompleted questionnaires, 3) lifetime presence of psychotic disorders, and 4) mental retardation. After removing 20 incomplete questionnaires, a final statistical sample of 200 cases was considered. After obtaining permission from the Department of Education of Yazd province and the approval of the school principals, the researchers met the students and invited them to participate in this research. They were informed about the topic and methodology. The researcher pledged to protect people's private information. After obtaining informed consent, participants were asked to answer the research questionnaires provided online. Participants were assured that their data would remain confidential. After collecting the data, incomplete questionnaires were ruled out, and the data of other participants were analyzed. They were given instructions to complete the

survey. SPSS software (version 23) was used to analyze the data paths and standard coefficients.

Cognitive Flexibility Inventory-Iranian Version

This inventory is a concise 20-item self-report tool designed to measure aspects of cognitive flexibility, allowing individuals to challenge and replace maladaptive thoughts with more adaptive thoughts. A range of 0 degrees from strongly disagree to strongly agree will be recorded. Each item was rated on a seven-point Likert scale, ranging from strongly disagree (1) to strongly agree (7). The designated scoring process for the CFI requires scoring against several items and then adding the response values numerically to arrive at a total score. Higher scores on the scale indicate higher cognitive adaptability; Lower scores indicate higher cognitive rigidity associated with lower cognitive adaptability to stressful situations (18). It can be used in clinical and non-clinical settings, and can also be used to assess a person's progress in developing flexible thinking in CBT for depression and other disorders. Other mental illnesses. The CFI was originally developed to measure three dimensions of cognitive flexibility: a) the tendency to view difficult situations as controllable; b) the ability to understand several different interpretations of events in human life and behavior. c) the ability to create multiple alternatives to difficult situations but is reduced to two factors and represents an appropriate level of value, reliability, and internal consistency. Specifically, Cronbach's alpha coefficient for the CFI scales, control scales, and substitution scales are 0.91, 0.84 and 0.91, respectively. The seven-week retest reliability coefficients for the CFI, control, and alternative scales were 0.81, 0.77, and 0.75, respectively (18). Furthermore, Cronbach's alpha coefficient and Iran's retest coefficient for CFI-I reliability are 0.90 and 0.71, respectively (19).

Adverse experiences in childhood relationships

Based on the classification of the Center for Disease Prevention and Control (CDC), (World Health Organization (WHO)) and using the Childhood Trauma Questionnaire (CTQ) and the Traumatic Experiences List (TEC) (20), 12 questions were developed to measure adverse experiences in childhood relationships, which will be referred to as the short term of adverse childhood relationships. These 12 items cover the four domains of misconduct behaviors (physical abuse, emotional abuse, lack of love, neglect), family relationship dysfunction (verbal and physical violence of spouses, divorce/separation), and absence of family members (parents, co-nurses). It asks the person about school events (bullying by peers, misbehavior of school principals) and sexual abuse (non-physical and physical) in the form of yes/no. A yes answer indicates that the person has experienced each relationship before the end of the age of 17(21). The reliability of this questionnaire in the current sample Cronbach's alpha was equal to 0.76, illustrating good internal consistency.

Readiness Scale for Substance Abuse (Zargar, 2007)

Weeds et al. (1992) developed the Addiction Readiness Scale. This questionnaire is an Iranian drug addiction readiness scale standardized against the psychosocial conditions of Iranian society (22). This questionnaire takes into account two factors and has 36 items plus five lie detector items. First, the scale's build value was calculated at 0.45 by correlating it with the 25-item scale of the clinical list of clinical signs, which is significant. The value of the scale calculated by Cronbach's alpha method is 0.90 which is optimal (23). Of course, each question will be scored on a continuous scale from 0 (strongly disagree) to 3 (strongly agree). This scoring will be reversed in questions 12, 15, 21 and 33. As expected, the questions will all receive scores on a continuous scale of 0 (very different) to 3 (similar) The reversal of this score will occur in questions 12, 15, 21, and 33. This test has a lie detector system consisting of questions 12, 15, 21, and 33. To get the total test score, the total score of each question (except the lie scale) must be added up. This score will range from 0 to 108. A higher score indicates that the respondent is better prepared for addiction and vice versa.

4.Result

The mean age of female students was 13.56±1.82 years. The majority of students were from three- and four-member families, and nearly 83% of cases were 13-14 years old.

Table 1 illustrates the mean scores of the tendency to abuse addictive substances, traumatic experiences in childhood, and cognitive flexibility were 56.95±4.73, 98.34±9.65, and 67.74± 5.19, respectively.

Table 1. Descriptive statistics of variables

variables	Mean±SD	Min	Max
Tendency to Abuse Addictive Substances	76.95±3.73	83	94
Traumatic experiences in childhood	98.34±9.65	43	129
Cognitive Flexibility	67.74± 5.19	23	138

According to Table 2, all correlation coefficients obtained between research variables are significant at P<0.01 level.

Table 2. Correlation matrix between research variables

Row	variables	1	2	3
1	Tendency to Abuse Addictive Substances	–	**0.591	- **0.483
2	Traumatic experiences in childhood	–	–	**0.619–
3	Cognitive Flexibility	-	-	–

P<0.01 **

From Table 3, the indexes that fit the search model include chi-squared (2.61), relative chi-squared (2.40), and fit index (0.993). Based on the results of the research model, the adaptive fit index (AGFI = 0.927), the comparative fit index (CFI = 0.948), and the root-mean-square error of approximation (RMSEA = 0.057) determined to assume that the model is in good condition.

Table 3. Structural equation model fitting indices

χ2	DF	P	χ^2/df	GFI	NFI	CFI	RMSEA
9.61	4	<0.001	2.40	0.993	0.906	0.948	0.057

DF: Degree of freedom, GFI: Goodness of Fit Index, IFI: Incremental Fit Index, CFI: Comparative Fit Index, RMSEA: Root Mean Square Error Approximation

Based on the results in Table 4, all the path coefficients associated with the final model are significant. Based on the standard coefficients in Table 4, the direct impact of childhood trauma on the propensity to abuse drugs is significant (β = 0.442, P <0.001). Furthermore, cognitive flexibility has a direct negative impact on drug abuse propensity (β=-0.413, P<0.05). This discovery confirmed the study's structural model.

Table 4. Structural model of paths and standard coefficients related to direct effects

Result of Direct Effect		P-value
Traumatic experiences in childhood > Tendency to Abuse Addictive Substances	0.442	0.001
Cognitive Flexibility > Tendency to Abuse Addictive Substances	-0.413	0.001

As demonstrated in Table 5, the two-variable correlation of the variables in the above table is significant at the P<0.01 level. The bootstrap result was 0.516. The lower limit of the confidence interval was calculated at 0.46, and its upper limit was 0.58. The significance level obtained is equal to 0.001, and the number of bootstrap resampling is 2000. Considering that zero is outside the confidence interval, the indirect effect is significant.

Table 5. Correlation between independent, dependent, mediator variables and bootstrap results

Row	variables	1	2	3
1	Tendency to Abuse Addictive Substances	–	**0.591	- **0.483
2	Traumatic experiences in childhood	–	–	**0.619–
3	Cognitive Flexibility	-	-	–
	Bootstrap value	lower bounds of the confidence interval	upper bounds of the confidence interval	P-Value
	0.516	0.46	0.58	0.001

5. Discussion

The purpose of the research was to determine whether cognitive flexibility played a role in predicting the link between childhood traumatic experiences and substance abuse tendencies in teenage girls. According to this study, individuals with traumatic childhood experiences exhibit greater cognitive flexibility and are more likely to be drug-addicted. Moreover, cognitive flexibility plays a role in linking childhood traumatic experiences to substance abuse preferences in teen girls. The results were consistent with the studies indicating a relationship between childhood traumatic experiences and the tendency to abuse addictive substances (24-27). Numerous studies have shown that traumatic childhood experiences can lead to significant and long-lasting negative effects on the brain and behavior (1), negatively predicting pro-social behavior (2), substance abuse and problem behaviors (8), anxiety symptoms in late adulthood (14), and early drug use (6,17). The model proposed by Schimmenti et al. recommends that experiences of neglect and abuse in childhood can lead to substance use and abuse, directly and indirectly, through dissociation resulting from unsuccessful attempts to integrate childhood maltreatment experiences. Certain forms of child

maltreatment were associated with increased use of certain substances. However, the experience of childhood neglect (both physical and emotional) plays a major role in the prediction of more substance use (24). The results of the study by Efrati et al. pinpointed that all addictive behaviors are associated with emotional abuse during childhood but not with other types of abuse (28). These findings are consistent with previous research showing that individual differences and environmental factors are both key to a better understanding of substance use among adolescents (29). These findings highlight that creating a healthy early nurturing environment can help individuals develop socially beneficial traits and behaviors later in life (2). The study's second conclusion confirmed that how easily someone's mind can change and adapt (cognitive flexibility) affects how childhood traumatic experiences are connected to substance abuse tendencies. These findings emphasize that creating benign early-rearing environments can facilitate individuals to develop prosocial traits and behaviors later in life (30), mediates the relationship between traumatic experiences in the childhood period and substance abuse proclivity (17), and mediates the relationship between childhood maltreatment and state anxiety (16). In addition, cognitive flexibility establishes a link between stress at the beginning of life and habitual behavior (6). The analysis of the mediating variables illustrated that cognitive flexibility exerts a marked effect on partial mediation between all the sub-dimensions of childhood abuse experiences and the tendency to drug abuse (17). As a result, the researchers show that individuals with higher levels of cognitive stress have lower levels of cognitive flexibility, and since those with less cognitive flexibility are less mindful, levels of cognitive flexibility are lower. Lower levels of mindfulness are associated with a reduced tolerance for suffering. The results were discussed under the relevant literature, and recommendations were made about their possible application (6,17, 30). Among 36 studies, many examined the impact of EF on other types of abuse (such as abuse, neglect, and exposure to intimate partner violence), and found a significant correlation between child maltreatment and EF. Similarly, a family member's mental illness (particularly maternal depression) is associated with poor EF outcomes. Relationships between other ACEs and EF results were not examined exclusively, including spousal abuse and incarceration of a family member. A more comprehensive understanding of outcomes linked to childhood experiences can be achieved through the consideration of EF, as seen in this review. The documentation of these relationships can aid in identifying ways to enhance prevention and treatment practices (31).

Among the various research perspectives on habit formation, learning, and reinforcement tools, are considered the main mechanisms driving habit acquisition during repeated response periods that ultimately together form a stimulus-response context or association in memory. (32). A normal series of actions begins when something in the environment or a signal tells us to start, and goal-directed actions are first controlled by a connection between a stimulus and a response, which makes it difficult to change our behavior (6). Although habits can make it easier for us to think and react quickly in difficult situations, when our habits become disordered, they can lead to harmful behaviors that are thought to cause substance abuse or obsessive-compulsive disorder (33). Changing habits is hard even when you try really hard and know that the things you're doing are bad for you. This is because as you keep doing something over and over, it becomes more automatic and you do it without thinking (34). For instance, when it comes to substance use disorders, going from using drugs casually to becoming addicted is seen as a problem with forming bad habits. This shift encourages a person to go from using drugs on impulse to using them regularly and eventually feeling like they can't stop (34). This change may clarify why people keep using the drug even when it doesn't make them feel good and is very harmful (6).

There are several limitations to this study. The correlational nature of the data precluded the determination of causal relationships between the variables. In addition, this sample primarily consisted of Yazd adolescent females. Using self-reported measures may have influenced our study results for a variety of reasons, including biased responses and social desirability. Additionally, influential variables such as economic status, and employment status of the parents of adolescents were not controlled for in the present study, which could have influenced the outcomes.

6. Conclusion

The results showed that cognitive flexibility is associated with traumatic experiences in childhood and a tendency toward substance abuse. Furthermore, cognitive flexibility mediates the association between traumatic experiences in childhood and the propensity for substance abuse in adolescent girls.

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the subject were observed through the reference number of the ethics committee. IR.IAU.REC. 1400.078.

Conflicts of interest

The authors of the article declared no conflict of interest.

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