

Structural Modeling of Risky Behaviors Based on Attention, Memory, and Inhibition Systems with the Mediating Role of Emotion Regulation in Female Drug Users

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ABSTRACT

Objective: The purpose of this study was to determine the structural model of risky behaviors based on attention, memory, and inhibition systems with the mediating role of emotion regulation in female drug users.

Methods: This research was descriptive-correlational and employed structural equation modeling. The study population consisted of all drug users (marijuana) in Isfahan who visited addiction treatment centers during 2023. The sample included 200 female drug users (marijuana) selected through convenience sampling based on inclusion and exclusion criteria. Data were collected using the Attention and Memory Improvement Software, Wechsler's Clinical Memory Test, the Behavioral Inhibition and Activation Scales (Carver & White, 1994), the Cognitive Emotion Regulation Questionnaire (Garnefski & Kraaij, 2006), and the Risk-Taking Behavior Questionnaire (Lejuez, 2002). In this study, descriptive statistics such as mean and standard deviation were used to organize, summarize, and describe the characteristics of the participants and research variables. In the inferential statistics section, structural equation modeling and Pearson correlation methods were employed for data analysis using SPSS.22 and AMOS.22 software.

Findings: Fit indices 0.599=PCFI, 0.611=PNFI, 2.88=CMIN/DF, 0.072=RMSEA, 0.913=IFI, 0.920=CFI, and 0.909=GFI indicated a good fit of the proposed model with the data. Hence, the proposed model is suitably fitted.

Conclusion: Thus, it can be concluded that the structural model of risky behaviors based on the attention system with the mediating role of emotion regulation fits well for drug-using individuals.

Keywords: Risky behaviors, Attention, Emotion regulation, Drug use.

1. Introduction

Risky behaviors are potentially destructive actions that individuals commit voluntarily or without awareness

of the adverse individual and societal consequences (Ghadimi Bavil Olyayi et al., 2023; Joghataei et al., 2023). In other words, risky behaviors encompass a range of actions that not only affect the individual involved but also cause

serious harm to significant others in their life, inadvertently causing damage to other members of a human bond (Daneşh et al., 2023; Ghadimi Bavi Olyayi et al., 2023; Joghataei et al., 2023). One such behavior is substance use in adults, which not only involves the individual in a flawed cycle but also incurs considerable psychological and financial costs to their community. To plan effective ways to prevent addiction, it is first necessary to understand the causes and factors influencing the initiation of substance use and addiction in youth. Genetic, neurocognitive, personality, educational, familial, environmental, and social factors all play roles in the etiology of addiction, and these factors interact with each other to lead to substance abuse and subsequently addiction (Barati et al., 2023). Although the prevailing thought is that most individuals complete the developmental cycle of adolescence with a stable psychological state and mental health, research conducted in the past decade indicates an increasing number of youths carrying behavioral or emotional signs within themselves (Chai, 2022; Shabtari et al., 2023). One of the causes and perpetrators of substance abuse disorder can be seen as individuals' inability or weakness in regulating their own moods. Research findings suggest that substance abuse results from low levels of emotion regulation strategies and an inability to effectively cope with and manage emotions, particularly at the onset of substance use.

One of the most common strategies is emotion regulation using cognitive strategies. Emotion regulation through cognition is evident in individuals' daily lives. Cognitions or cognitive processes help individuals regulate their emotions and feelings and not be overwhelmed by the intensity of emotions (Bahadori Khosroshahi, 2017; Garland, 2021). Cognitive emotion regulation refers to the cognitive management and manipulation of emotion-evoking information; in other words, cognitive emotion regulation strategies refer to how individuals think after experiencing a negative event. Strategies that individuals use to regulate impulses have been extensively studied in both theoretical and applied research, and these strategies are discussed as adaptive and maladaptive strategies. Garnefski and colleagues have identified nine different cognitive emotion regulation strategies, divided into positive and negative categories. Self-blame, blaming others, rumination, and catastrophizing are strategies that comprise the negative cognitive emotion regulation strategies. Acceptance, refocusing on planning, positive refocusing, positive reappraisal, and adoption of perspective are strategies that make up the positive emotion regulation strategies. It seems

that the use of each unique strategy carries different benefits and costs, such as non-adaptive physiological responses or disruption in social functioning. Using positive cognitive emotion regulation strategies leads to a reduction in the experience of unpleasant states, and those who employ these strategies pay no physiological, emotional, and social price (Garland, 2021). Other studies have shown that the ability to use positive cognitive emotion regulation strategies, in addition to reducing the experience of negative emotions, can lead to an increase in the experience of positive emotions, thus it can be assumed that the type of cognitive emotion regulation strategy is a significant factor affecting individuals' mental health and resilience levels (Bahadori Khosroshahi, 2017; Garland, 2021; Mashhadi et al., 2011).

Few studies have explored the mediating role of emotion regulation with memory and attention with a focus on inhibition, and most existing research has focused on its role in psychological taxonomy discussions. Researchers have shown that drug use has a lasting effect on individuals' brain structure and can change their functioning throughout their lives. These effects can influence their choices, attitudes towards life, memory, moods, etc. One of the most important human capabilities is the functioning of memory and precise attention to an individual's surrounding variables. It is noteworthy that cognitive functions are embedded throughout individuals' lives. Humans have encountered a wide range of situations requiring different forms of emotion regulation (Garland, 2021). On the other hand, the inability to effectively regulate individual states can have detrimental effects on mental health; unsuccessful emotion regulation may be the source of various psychological issues and can also interfere with an individual's performance in important life areas (such as work and social relationships) (Gross, 2002; Koch et al., 2019; Sedighi Arfaee et al., 2021; Wang & Saudino, 2013).

On the other hand, an individual can manage their emotions and states when their mind can retrieve memories or previously learned skills to address a problem or issue. In this way, the importance of memory and selective attention in various situations becomes apparent to us. Inhibition is an action that can slow down or completely prevent a behavior in different situations. To deeply understand addicts who have recently quit drug use, they initially need to be able to create pauses in the preparation and consumption of substances and subsequently, with the help of others, revisit prior situations, recall the costs paid due to substance use, etc., and deter themselves from using substances. In other words, self-inhibition is the other side of the self-regulation

coin. The question now is why, despite repeated training through media or relevant institutions, individuals revert to drug use, and how the functioning of memory, attention, and inhibition, mediated by emotion regulation skills, operates in these individuals. Ultimately, this research aims to respond to the question of what patterns exist in individuals who use substances that involve or impair the attention and memory system, or whether when individuals use drugs, their memory and attention are disrupted, or they recall specific images and experiences (Kozak & Fought, 2011; Shabtari et al., 2023). From a cognitive perspective, individuals involved in addiction and substance use in cognitive domains exhibit dysfunctions, which itself can highlight the importance of this research in such a way that if a detailed look is taken at the cognitive processes of drug users, it could reassess the dysfunction and meta-cognitive issues they face, and ideally, find an effective solution for managing this social issue (Farrokhi et al., 2023; Nateghi et al., 2019). When individuals are pressured to use substances, their poor management of emotions increases the likelihood of use, and conversely, effective emotion management reduces the likelihood of misuse. The ability to regulate emotions enables individuals to use appropriate coping strategies in situations where drug use or abuse is likely (Heidari et al., 2013; Kozak & Fought, 2011; Shabtari et al., 2023; Yarmohammadi Vasel et al., 2015).

Therefore, it can be said that emotion regulation is a key and determining factor in psychological well-being and effective functioning. However, part of memory and attention plays an important role in recalling mental and cognitive skills. In such a way that if human memory is weak in similar situations, or attention is disrupted, then at that very moment, emotional regulation and cognitive skills might function inefficiently and even destructively. The dependent variable in this research is risky behaviors, and the mentioned independent variables can have significant effects on an individual's risky behavior, but the mediating variable of emotional regulation, which is different from other independent variables (cognitive and perceptual variables), can change the outcomes of this research. Emotion regulation is one ability that individuals can use when faced with stressful and risky situations to move from crisis conditions to manageable conditions. Ultimately, this research aims to examine the structural model based on the risky behaviors of individuals who use drugs to study the role of the attention, memory, and inhibition systems and the mediating role of emotion regulation in women in the city of Isfahan.

2. Methods

2.1. Study design and Participant

This research was descriptive-correlational and utilized structural equation modeling. The statistical population included all female drug users (marijuana) in Isfahan who visited addiction treatment centers in 2023. The current study's sample consisted of 200 female marijuana users selected via convenience sampling based on entry and exit criteria. According to Klein, about 15 samples per observed variable are needed if structural equation modeling is used, and a minimum sample size of 200 is defensible (Kline, 2022). Entry criteria for the study included being female, a drug user, aged between 25 to 40 years, literate, having used substances for a year or more, and willing to participate in the study. However, exit criteria from the study included non-cooperation and damaged questionnaires.

In the current study, negotiations were initially held with addiction treatment centers in Isfahan, following which, with the consent of the center officials and the signing of an ethical agreement by the researcher, sample group members were selected by them. Participants were then given an overview of the overall procedure, and upon their agreement to participate, they were provided with initial information about the research and given the research questionnaires to complete. Ethical considerations of the research were as follows: 1- All individuals received written information about the research and participated voluntarily. 2- Confidentiality of all information was assured, to be used only for research purposes. 3- To respect privacy, the names and surnames of participants were not recorded.

2.2. Measures

2.2.1. Attention

In this research, attention refers to the score a person achieves on the focused and scattered attention test by the Sina Institute, developed by Yazdi in 2011. This test had a validity of 0.87, which is considered acceptable. The execution method involves displaying a screen on a computer monitor. The participant creates space by pressing the space bar upon seeing a circle and candle icon but must be careful not to press any button if another shape appears. The time and number of correct responses are recorded in the system and ultimately evaluated based on the pattern of frequency and speed of attention (Bahadori Khosroshahi, 2017; Iceta et al., 2021; Mashhadi et al., 2011; Nejati, 2013).

2.2.2. Memory

This scale includes 18 subtests. These subtests are designed to assess learning and memory across a range of adult ages. They include: information and orientation, logical memory, faces, paired-associates learning, family pictures, word lists, visual reproduction, digit-symbol coding, spatial span, mental control, and body adjustments. From these subtests, seven indices can be assessed: auditory immediate, visual immediate, immediate memory, auditory delay, visual delay, delayed auditory recognition, general memory, and working memory (Bahadori Khosroshahi, 2017; Beroun et al., 2019; Chen et al., 2021; Dagher et al., 2021; Louragli et al., 2020; Nejati, 2013).

2.2.3. Cognitive Emotion Regulation

Emotion regulation refers to the score a person obtains on the Cognitive Emotion Regulation Questionnaire (Garnefski & Kraaij, 2006). This 18-item tool measures cognitive emotion regulation strategies in response to threatening and stressful life events on a five-point Likert scale from 1 (never) to 5 (always), encompassing 9 subscales as follows: self-blame, other-blame, focus on thought/rumination, catastrophizing, putting into perspective, positive refocusing, positive reappraisal, acceptance, and refocusing on planning. The minimum and maximum scores on each subscale range from 2 to 10, respectively, with higher scores indicating greater use of that cognitive strategy. The Cognitive Emotion Regulation Questionnaire categorizes cognitive emotion regulation strategies into two general types: adaptive (adjusted) strategies and non-adaptive (maladjusted) strategies. The subscales of putting into perspective, positive refocusing, positive reappraisal, acceptance, and refocusing on planning are adaptive strategies; whereas the subscales of self-blame, other-blame, focus on thought/rumination, and catastrophizing are non-adaptive strategies. Positive and negative cognitive emotion regulation strategies in this study are calculated from the total score each individual obtains in response to the subscales of positive and negative regulation of the

questionnaire (Nasiri et al., 2022; Rajabi, 2018; Sedighi Arfaee et al., 2021; Shiroodaghaei et al., 2020).

2.2.4. Behavioral Inhibition

The Behavioral Inhibition and Behavioral Activation Systems (BIS/BAS) Questionnaire, developed by Carver and White, is designed to assess individual differences in sensitivity to behavioral inhibition and activation systems. This scale consists of 20 items that assess the activity of the behavioral inhibition system via a subscale of sensitivity to punishment and the activity of the behavioral activation system via three subscales of sensitivity to reward, drive, and fun-seeking (Badiie et al., 2021; Faghfouriazar, 2023).

2.2.5. Risky Behavior

Risky behaviors in this study refer to the score obtained on the BART risk-taking test developed by Professor Lejuez in 2002. This computer-based test examines real-world risk-taking behavior and assesses the participant's risk-taking strategy. The program is designed to analyze risk-taking that is profitable and rewarded, and uncontrolled risk-taking that results in assumed penalties (Bahadori Khosroshahi, 2017; Dabirinejad et al., 2023; Karsazi et al., 2017).

2.3. Data Analysis

In this study, descriptive statistics such as mean and standard deviation were used to organize, summarize, and describe the characteristics of the subjects and research variables. In the inferential statistics section, structural equation modeling and Pearson correlation methods were used for data analysis using SPSS.22 and AMOS.22 software.

3. Findings and Results

In this study, 200 female drug users from the city of Isfahan were selected as the research sample. Table 2 presents the descriptive statistics (mean, standard deviation, skewness, and kurtosis) for the research variables.

Table 1

Descriptive Indices (Mean and Standard Deviation) of Research Variables (n=200)

Variable	Mean	Standard Deviation	Tolerance Coefficient	Variance Inflation	Skewness	Kurtosis
Risky Behaviors	31.73	8.20	0.385	3.125	0.000	-0.226
Attention	149.30	27.02	0.321	3.991	-0.094	0.509
Inhibition	15.91	3.65	0.502	2.542	0.051	0.117
Memory	103.71	12.21	0.730	1.988	-0.128	0.106
Emotion Regulation	53.70	12.60	0.445	2.830	0.062	-0.210

Based on the data in Table 1, since all research variables' skewness and kurtosis are between -2 and 2, it can be concluded that the data are normally distributed. In this study, multicollinearity was examined using the Tolerance and Variance Inflation Factor statistics. No multicollinearity

was observed among the research variables (Table 1). Table 2 displays the Pearson correlation information between the predictor, mediator, and dependent variables of the proposed model.

Table 2

Correlation Matrix Between Predictor, Mediator, and Dependent Variables of the Proposed Model

Research Variables	1	2	3	4	5
1. Risky Behaviors	1				
2. Emotion Regulation	-0.41**	1			
3. Inhibition	-0.22**	0.49**	1		
4. Memory	-0.96**	0.20**	0.38**	1	
5. Attention	-0.20**	0.27**	0.41**	0.32**	1

*P < 0.01, P < 0.05

According to the results in Table 2, the correlation relationships among the research variables are statistically significant at a 5% error rate. Initially, the assumptions of the structural model were examined, followed by the reporting of the proposed model's fit. The results of the fit indices for the proposed research model, based on the structural model of risky behaviors in accordance with the

attention, memory, and inhibition systems with the mediating role of emotion regulation in drug users, showed indices of PCFI = 0.599, PNFI = 0.611, CMIN/DF = 2.88, RMSEA = 0.072, IFI = 0.913, CFI = 0.920, and GFI = 0.909, indicating a good fit of the proposed model with the data. Thus, the proposed model is considered to have satisfactory fit.

Table 3

Total Path Coefficients Between Variables of Risky Behaviors Based on Attention, Memory, and Inhibition Systems with the Mediating Role of Emotion Regulation

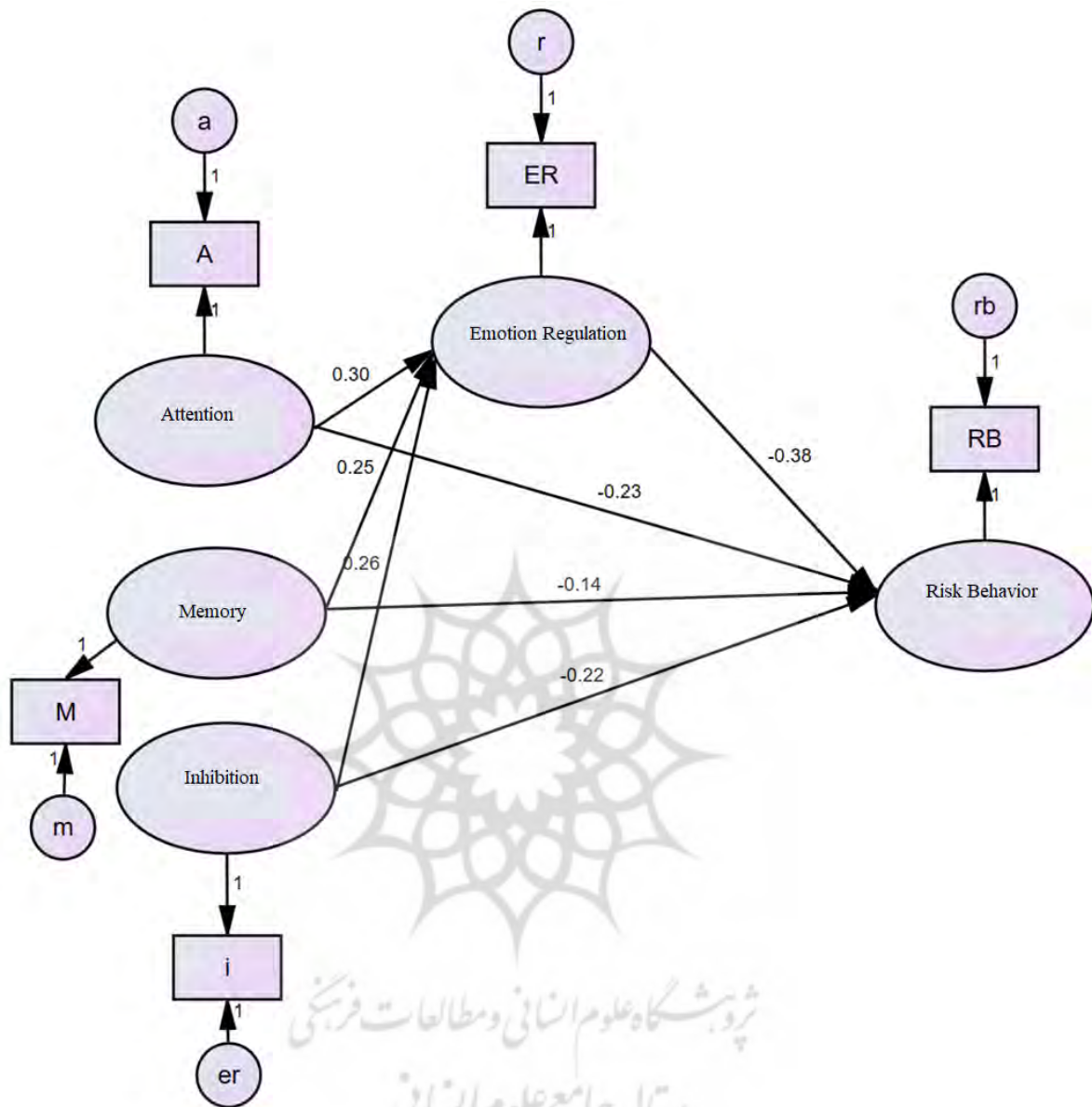
Paths	Standardized Factor Loading β	Probability Value
Total Path		
Attention → Emotion Regulation → Risky Behaviors	-0.68	0.001
Memory → Emotion Regulation → Risky Behaviors	-0.63	0.001
Inhibition → Emotion Regulation → Risky Behaviors	-0.64	0.001
Emotion Regulation → Risky Behaviors	-0.38	0.001
Attention → Risky Behaviors	-0.23	0.001
Memory → Risky Behaviors	-0.14	0.028
Inhibition → Risky Behaviors	-0.22	0.001

The results from Table 3 showed that the indirect effects were significant, thus indicating that emotion regulation plays a mediating role in the relationship between risky behaviors, attention, memory, and inhibition systems. Figure

1 displays the standardized coefficients (path weights or betas) related to the direct effects of variables on each other in the proposed research model.

Figure 1

Model with Beta Coefficients



In Figure 1, the numbers on the paths represent the path weights or betas. The highest coefficient (-0.38) belongs to the path from emotion regulation to risky behaviors, and the lowest coefficient (-0.14) is associated with the path from memory to risky behaviors.

4. Discussion and Conclusion

The aim of the present study was to determine the structural model of risky behaviors based on attention, memory, and inhibition systems with the mediating role of emotion regulation in female drug users. The statistical analysis results showed that the fit indices were indicative of

a good fit of the proposed model with the data. Therefore, it can be concluded that the structural model of risky behaviors based on the attention system with the mediating role of emotion regulation fits well for drug-using individuals. The findings of the present study are consistent with the results of several previous domestic and international studies (Badiie et al., 2021; Bahadori Khosroshahi, 2017; Dabirinejad et al., 2023; Faghfouriazar, 2023; Gross, 2002; Karsazi et al., 2017; Koch et al., 2019; Mashhadi et al., 2011; Nasiri et al., 2022; Rajabi, 2018; Sedighi Arfaee et al., 2021; Shiroodaghaei et al., 2020; Wang & Saudino, 2013; Yarmohammadi Vasel et al., 2015).

It can be explained that drug use causes deterioration in the functioning of the prefrontal cortex in cognitive processes such as memory and attention, gradually leading to an increase in cognitive damage over time, sometimes to the extent that these damages become irreparable (Ikita et al., 2021). Additionally, addiction is associated with impairments in cognitive functions such as inhibition, and addicted individuals exhibit lesser inhibitory response and poorer planning abilities compared to normal individuals (Lee et al., 2019; Vogel et al., 2019). Furthermore, evidence suggests that addicted individuals not only suffer from memory problems but also experience memory errors, which hinder their ability to rely on their memory when making decisions about engaging in risky behaviors and prevent them based on inhibitory results stored in memory (Bahadori Khosroshahi, 2017). Previous research also indicates that drug use has a lasting impact on individuals' brain structures and can alter their functioning throughout their lives, affecting their choices, attitudes towards life, memory, and emotional states (Beroun et al., 2019; Dagher et al., 2021). Moreover, research has shown that a disturbance in the balance of the inhibitory system function leads to risky behaviors (Wang et al., 2020) such that a low activity and sensitivity of the inhibitory system reduce the behavioral stop signals, sensitivity to punishment, and consequently avoidance of harmful and risky behaviors, thereby playing a role in the occurrence of more risky behaviors (Dagher et al., 2021; Wang et al., 2020). It is also worth noting that attention, the ability to inhibit irrelevant information while performing a task, and enhancing the processing of important information are crucial. Additionally, inhibition is a function that can slow down or completely prevent a behavior in various situations (Beroun et al., 2019). Given that addicted individuals suffer from memory problems and memory errors, not only is their attention system not functioning adequately, but it may also fail to prevent information that leads to risky behavior due to memory errors. Given that these individuals also have weaknesses and defects in the behavioral inhibition system, the model proposed that the attention, memory, and behavioral inhibition systems can predict risky behaviors in addicted individuals was justified.

To explain this finding and to delineate the mediating role of emotion regulation in this model, it can be said that cognitive emotion regulation refers to the cognitive management and manipulation of information that evokes emotion. In other words, cognitive emotion regulation strategies are how people think after experiencing a negative

event (Courtwright, 2019). Therefore, individuals lacking the necessary skills to cope with their emotional experiences are more likely to engage in risky behaviors when managing and controlling negative emotions. Since flawed and maladaptive emotion regulation methods are significant predictors of risky behaviors (Bahadori Khosroshahi, 2017), emotion regulation can strengthen the existing relationship in the model presented in the previous hypothesis as a mediating variable, thereby providing the model with a satisfactory fit. In other words, the ability to regulate and manage emotions prevents individuals from choosing risky behaviors in decision-making processes, thus emphasizing the importance of emotion regulation in addicted individuals who are always prone to revert to negative emotional states, which they try to escape through addiction, consequently making them susceptible to engaging in risky behaviors (Bahadori Khosroshahi, 2017; Garland, 2021). Therefore, emotion regulation can enhance the relationship between the memory, attention, and behavioral inhibition systems with risky behaviors in this model as a mediating variable, thereby providing the proposed model with a good fit.

Further explaining this finding, it can be stated that an individual can manage their emotions and states when their mind can retrieve memories or previously learned skills to address a problem or issue (Iceta et al., 2021; Mashhadi et al., 2011; Vogel et al., 2019). This demonstrates the importance of memory and selective attention in various situations. Additionally, inhibition is an action that can slow down or completely prevent a behavior in different situations. For a deeper understanding of addicts who have recently quit drug use, they initially need to be able to create pauses in the preparation and consumption of substances and subsequently, with the help of others, revisit prior situations, recall the costs paid due to substance use, etc., and deter themselves from using substances. In other words, self-inhibition is the other side of the self-regulation coin (Lee et al., 2019). Further explaining this finding, it can be said that individuals with low levels of emotion regulation impulsively engage in risky behaviors. These individuals, instead of turning to their memory and reflecting based on it, tend to make hasty decisions. It is also important to note that memory and attention play a crucial role in recalling mental and cognitive skills. In such a way that if human memory is weak in similar situations or attention is impaired, at that very moment, emotional regulation and cognitive skills might function inefficiently and even destructively. Additionally, when the behavioral inhibition system is weak, emotion regulation can act as a mediating variable to

encompass the inability to inhibit the initial response and the inability to strive to act on the secondary response. It can also be said that in the decision-making process, which is a high cognitive processing, emotions intervene in evaluating the importance of environmental stimuli and the individual's susceptibility to gains and losses in the past or future, indicating that risky decision-making is influenced by emotions (Nejati, 2013).

Therefore, it can be argued that low levels of emotion regulation amplify the inefficiency of the attention system in addicted individuals, and emotion regulation along with these variables can enhance the predictive power of the occurrence of risky behaviors as a mediating variable.

5. Suggestions and Limitations

This research, like any other research, has limitations, which are addressed below. Additionally, practical recommendations and further research proposals have been made in light of the results obtained. The sampling selection of the study was from individuals attending counseling centers and limited to one area of Tehran city; therefore, caution should be exercised in generalizing the findings of this research and all experimental studies with human samples. Participants' attitudes toward the tests used, their level of cooperation with the researcher, and their honesty and interest in cooperation in the research are factors that are almost beyond the researcher's control and can influence the research results. The use of questionnaires as data collection tools can affect the results in two ways: firstly, the reliability of the tool itself has some degree of error because no tool's reliability equals one and there is always some error in measuring the variable of interest; secondly, participants' response bias can be present, and adherence to the principle of honesty may not be observed by them, all of which reduce the generalizability power of the research results.

Given the results obtained in this study and considering its limitations, the following recommendations are suggested for conducting further research in the future: It is suggested that due to the importance of the research topic, a similar study should be conducted for other communities, incorporating different variables, particularly more independent and dependent variables, and especially mediator and moderator variables, and comparing the results with the current research. Considering the principle of falsifiability in science and the necessity of caution in generalizing results, the findings of the present study should be critically analyzed with high precision, and further

research should be conducted towards refining and presenting a more comprehensive model. It is suggested that researchers utilize the model derived from the present study in developing and formulating therapeutic protocols. It is suggested that in effectiveness studies conducted on the addicted population, the model derived from this research and its constituent variables be utilized. It is suggested that more attention be paid to emotion regulation in future research, given its role in the research model. Counseling centers, addiction treatment clinics, and addiction prevention centers can utilize the model derived from this research. Specialists and therapists are recommended to use the model derived from the present research in therapeutic approaches and various techniques, especially emotion-focused techniques, in their work. Given the importance of treatment, especially addiction prevention, and considering that addiction itself is considered a high-risk behavioral issue, the model of this research can be used both in treatment and prevention of addiction. It is suggested that integrative cognitive and emotion-focused approaches be included in the agenda of addiction specialists and high-risk behavior practitioners. It is recommended to use the model presented in this research in psychological workshops related to addiction issues.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

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

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