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Structural Equation Modeling of Drug Use Tendencies Based on Emotional Reactivity and Self-Criticism Levels: Mediating Role of Rumination

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ABSTRACT

Objective: This study aimed to develop a structural equation model to predict drug use tendency based on emotional reactivity and self-criticism, with the mediating role of rumination.

Methods: The research employed a descriptive–correlational design using path analysis. The statistical population included all individuals who attended the Bani Nik Substance Abuse Center during the first six months of 2024. Using convenience sampling and accounting for potential attrition, 250 eligible participants were selected. Data were collected using the Emotional Reactivity Questionnaire, the Self-Criticism Scale, the Rumination Scale, and the Addiction Tendency Questionnaire. Descriptive statistics were calculated, normality was assessed with the Smirnov test, and Pearson correlations were analyzed in SPSS v.24. Path analysis with AMOS and the bootstrap test were applied to examine mediating effects.

Results: The proposed structural model demonstrated acceptable fit indices. Direct effects of both emotional reactivity and self-criticism on drug use tendency were significant. Moreover, rumination played a mediating role: higher levels of emotional reactivity and self-criticism increased rumination, which in turn elevated drug use tendency. These findings highlight rumination as a critical pathway linking individual vulnerabilities to substance use behaviors.

Conclusions: The study underscores the dual direct and indirect roles of emotional reactivity and self-criticism in shaping susceptibility to drug use. Addressing maladaptive rumination, alongside managing emotional reactivity and self-critical tendencies, may serve as an effective preventive and therapeutic approach in substance use interventions.

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Introduction

For centuries, human beings have used psychoactive substances in the hope of alleviating pain, reducing distress, or even seeking pleasure and happiness. In contemporary Iran, substance use has emerged as a major public health concern, with prevalence rates estimated at approximately 7% among adolescents and 19% among adults (Kandi, Farrokhzad, & Taheri, 2022). According to the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5),* substance use disorder is characterized by a cluster of cognitive, behavioral, and physiological symptoms that indicate continued substance use despite significant problems related to its consumption (American Psychiatric Association, 2020). Globally, the United Nations Office on Drugs and Crime (UNODC) estimates that around 200 million individuals aged 15–64 (5% of the global population) use illicit drugs, including 16 million who use opioids and 11 million who use heroin. In Iran, the number of substance users is estimated at between 1.8 to 3.3 million, with opioids being the most commonly used substances (Mokri, 2002). Official statistics suggest that approximately 1.35 million Iranians meet the criteria for substance dependence, which—considering average household size—implies that nearly five million people in the country are directly affected by substance use disorders each year (Drug Control Headquarters, 2013).

Among the psychological factors influencing vulnerability to addiction, *emotional reactivity* plays a central role. Intense behavioral problems are often considered attempts to escape or avoid overwhelming emotional responses triggered by adverse experiences (Moghbeli Henzai, Zanjani, & Omidi, 2020). Emotional reactivity refers to the intensity, duration, and persistence of emotional responses to stimuli, and the time required for the individual to return to baseline or emotional stability (E'tesamipour & Einollahi Maryan, 2023). Another critical construct implicated in psychopathology and maladaptive emotion regulation is *self-criticism,* identified as a core feature underlying a wide range of mental disorders (Farsi Jani, Ebrahimnejad Moghadam, & Malhi, 2021). According to the theoretical framework proposed by Zuroff and colleagues (2005), motivational, cognitive, and interpersonal dimensions of self-criticism dynamically interact with environmental factors, thereby amplifying and maintaining psychological distress. Thompson and Zuroff (2004) distinguished between two maladaptive forms of negative self-evaluation: *comparative self-criticism,* in which individuals view themselves unfavorably in relation to others,

and *internalized self-criticism*, characterized by harsh self-condemnation. Both dimensions foster dissatisfaction and psychological vulnerability in social interactions.

A further mechanism that links emotional and cognitive vulnerabilities to maladaptive outcomes such as addiction is *rumination*. Rumination is an ineffective cognitive–emotional regulation strategy that involves repetitive, negative, and self-focused thought patterns in response to distress (Pincus et al., 2022). Empirical studies have shown that rumination contributes to psychological disturbances, exacerbates negative affect (such as anger and stress), and is strongly associated with mood and anxiety disorders, obsessive-compulsive disorder, and post-traumatic stress disorder (Nolen-Hoeksema & Morrow, 1991; May et al., 2022). In the context of addiction, rumination has been linked to relapse vulnerability, as demonstrated by Haeri Meybodi et al. (2021), who found a significant association between recurrent negative thinking and substance use relapse. Similarly, Chamani and Sajadian (2019) reported that anxiety, peer relationship problems, bullying, and rumination significantly predicted addiction proneness.

Substance use and addiction, often referred to as one of the four crises of the 21st century, represent one of the most serious biopsychosocial challenges worldwide. Addiction not only jeopardizes the health and well-being of individuals and families but also undermines the economic, social, and cultural stability of societies (Moghaddam, 2022). Given these wide-ranging consequences, identifying the psychological mechanisms underlying susceptibility to addiction remains an urgent priority. Despite the theoretical and empirical importance of emotional reactivity, self-criticism, and rumination in explaining substance use tendencies, no study has directly examined these variables together in the Iranian population.

Accordingly, the present study seeks to address this gap by testing a structural equation model of addiction tendency based on emotional reactivity and levels of self-criticism, with rumination as a mediating variable. Specifically, the study aims to determine whether rumination mediates the relationship between emotional reactivity, self-criticism, and the tendency to use drugs.

Material and Methods

The present study was applied in nature and employed a descriptive–correlational design using path analysis. The statistical population consisted of all individuals who attended the Bani Nik Substance Abuse Treatment Center during the first six months of 2024. In structural equation

modeling (SEM) research, there is some debate regarding the required sample size; however, scholars generally agree that SEM, similar to factor analysis, requires relatively large samples and that a minimum of 200 participants is sufficient for an adequate model fit (Tabachnick et al., 2007). Considering that larger sample sizes yield better model fit and to account for potential attrition, a total of 250 eligible individuals were selected through convenience sampling.

To examine the relationships among the study variables, data were analyzed using Pearson correlation in SPSS version 24, while path analysis and bootstrap procedures were conducted in AMOS to assess mediating effects.

Instruments

Emotional Reactivity Scale: Developed by Nock et al. (2008), this 21-item unidimensional instrument measures emotional sensitivity, intensity, and persistence. Items are scored on a four-point Likert scale ranging from 0 to 4, with a total score range of 0–84. The original developers reported strong convergent and discriminant validity, as well as criterion validity through associations with self-harming thoughts and behaviors. Cronbach's alpha was reported at .94. In Iran, Sajadi Nejad Vakberi (2022) confirmed its factorial validity using confirmatory and exploratory factor analyses and reported reliability indices of .91 (internal consistency), .87 (split-half), and .86 (test–retest).

Self-Criticism Scale: Developed by Thompson and Zuroff (2004), this 22-item scale measures maladaptive self-critical tendencies. Responses are rated on a seven-point Likert scale (0 = "not at all descriptive of me" to 6 = "very descriptive of me"). The original developers reported Cronbach's alpha at .81 and confirmed its face validity. In an Iranian sample, Nourbala (2012) reported internal consistency of .90 and satisfactory construct validity.

Ruminative Response Scale (RRS): Designed by Nolen-Hoeksema and Morrow (1991), this self-report measure assesses cognitive responses to negative mood. The rumination subscale consists of 22 items rated on a four-point Likert scale (1 = "almost never" to 4 = "almost always"). Reported internal consistency was .89, and test–retest reliability ranged from .48 to .80. In Iran, Lotfinia (2007) found reliability of .82 over a three-week interval.

Addiction Tendency Questionnaire: Developed by Farchad (2006), this 16-item scale assesses tendencies toward substance use across three domains: social, individual, and environmental. Items are rated on a five-point Likert scale (1 = "very low" to 5 = "very high"). Content validity

was confirmed by experts, and internal consistency reliability using Cronbach's alpha was reported at .79 (Mir Hesami, 2009).

Ethical Considerations

This study was conducted in accordance with the ethical standards of the Declaration of Helsinki. Prior to data collection, approval was obtained from the institutional ethics committee. All participants were informed about the study objectives, the voluntary nature of their participation, and their right to withdraw at any time without penalty. Written informed consent was obtained from all participants. Confidentiality and anonymity of responses were assured, and data were used solely for research purposes. To protect the well-being of participants, those who exhibited severe psychological distress during the study were referred to appropriate clinical services at the treatment center.

Results

To examine the fit of the structural model predicting substance use tendency based on emotional reactivity and levels of self-criticism with the mediating role of rumination, structural equation modeling (SEM) was applied. Prior to SEM analysis, univariate outliers were identified using boxplots, and multivariate outliers were examined with the Mahalanobis statistic; identified outliers were removed from the dataset. Skewness and kurtosis values were computed in SPSS, and none exceeded the acceptable range of ±1. Normality of the data was further confirmed using the Kolmogorov–Smirnov test, which indicated that the distribution of scores for all four model variables was normal ($p > .05$).

The assumption of error independence was tested using the Durbin–Watson statistic, confirming no violation. Multicollinearity was assessed using Pearson's correlations among variable pairs. Since no correlations reached or exceeded .90, collinearity was not problematic. Additionally, tolerance values and variance inflation factors (VIF) were examined, revealing no tolerance values below .10 or VIF values above 10, indicating no multicollinearity. Following confirmation of assumptions, SEM was conducted to evaluate the hypothesized model. Figures 1 presents the standardized path coefficients.

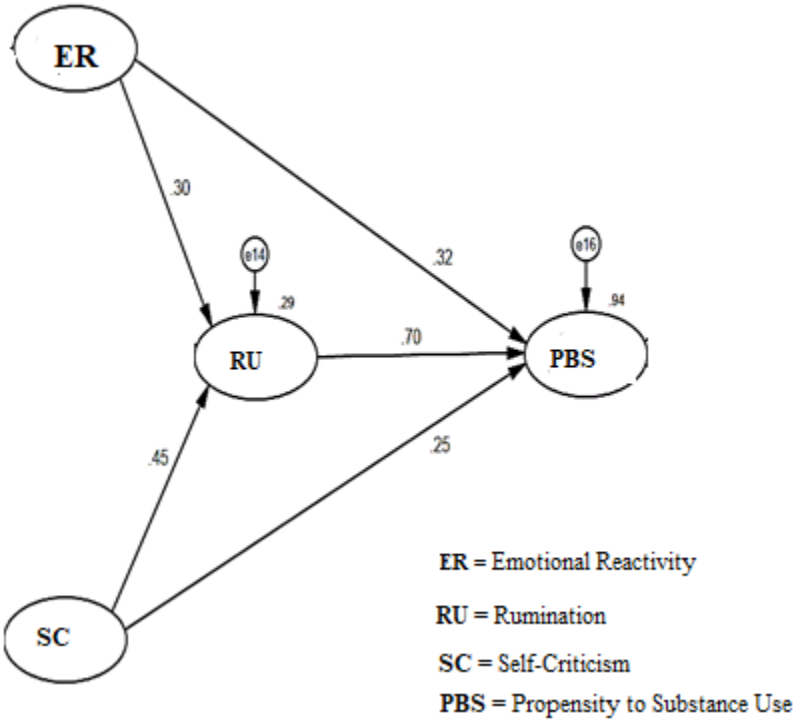

Figure 1. standardized path coefficients

Table 1 summarizes the model fit indices. The chi-square to degrees of freedom ratio (χ^2/df) was 4.368, within the acceptable range of 1–5. The root mean square error of approximation (RMSEA = 0.066) and standardized root mean square residual (SRMR = 0.071) were both below the recommended cutoff of 0.08. Additionally, the incremental fit index (IFI = 0.902), comparative fit index (CFI = 0.900), and goodness-of-fit index (GFI = 0.918) all exceeded the recommended threshold of 0.90. Collectively, these indices indicate that the proposed structural model demonstrated a good fit with the data.

Table 1. Model Fit Indices

Fit Index	Acceptable Range	Observed Value	Fit Evaluation
df/χ^2	≤ 5	4.368	Good
IFI	> 0.90	0.902	Good
RMSEA	< 0.08	0.066	Good
SRMR	< 0.08	0.071	Good
CFI	> 0.90	0.900	Good
GFI	> 0.90	0.918	Good

Table 2 presents the measurement model coefficients. The regression weights for the indicators of emotional reactivity (sensitivity, intensity, persistence), self-criticism (internalized, comparative), rumination (ruminative responses, distraction), and substance use tendency (social, individual, environmental) were all significant ($p < .01$). These findings confirm that all observed variables were valid indicators of their respective latent constructs.

Table 2. Coefficients of the Measurement Models

Path			ß (Unstandardized)	Standardized Coefficient	C.R.	P
Emotional Reactivity	to	Sensitivity	1	0.400		
Emotional Reactivity	to	Intensity	1.497	0.754	4.876	0.01
Emotional Reactivity	to	Emotional Persistence	1.393	0.624	4.873	0.01
Levels of Self-Criticism	to	Internalized Self-Criticism	1	0.941		
Levels of Self-Criticism	to	Comparative Self-Criticism	0.703	0.603	6.198	0.01
Rumination	to	Rumination Responses	1	0.768		
Rumination	to	Distracting Responses	1.499	0.852	12.187	0.01
Propensity to Substance Use	to	Social	1	0.743		
Propensity to Substance Use	to	Individual	0.686	0.703	10.676	0.01
Propensity to Substance Use	to	Environmental	1.470	0.736	11.185	0.01

In summary, the measurement and structural model demonstrated good fit, and the significant factor loadings indicate that emotional reactivity, self-criticism, and rumination adequately explain the variance in substance use tendency.

Discussion

Based on the obtained results, the path coefficient for the relationship between emotional reactivity and propensity for substance use was positive and significant. Therefore, the research hypothesis regarding the direct effect of emotional reactivity on the tendency to use substances is confirmed. This finding suggests that higher emotional reactivity is associated with an increased likelihood of substance use. These results align with previous studies in this field.

For example, Vatandoust et al. (2023) found that emotional regulation plays a mediating role in the relationship between basic psychological needs and substance use among students. Mina and Amini Manesh (2021) reported a significant negative correlation between emotional dysregulation

and risky behaviors. Mosavi Nasab and Bahrami (2021), in their study on students in Qom, found that substance use tendencies were significantly and negatively correlated with emotional self-regulation, self-efficacy, and resilience. Hayeri Meybodi et al. (2021) demonstrated that relapse to addiction was positively associated with ruminative thinking (repetitive negative thoughts, perceived inefficacy, and cognitive occupation) and negatively associated with emotional self-awareness and mindfulness. Similarly, Khanehkeshi, Khanmohammadi Otaghsara, and Malkian (2017) reported that emotional instability, prosocial behavior, and aggression all contributed to readiness for substance use. Gull et al. (2020) found that emotional dysregulation was associated with substance use motives among users, and Clancy and McChargue (2009) showed a significant relationship between emotional responses in individuals with trauma history and substance dependence.

These findings suggest that emotional reactivity is a key factor influencing substance misuse. High emotional reactivity often leads to the use of maladaptive emotion regulation strategies, which in turn increases the likelihood of substance use. Individuals who cannot control their arousal are more vulnerable to substance misuse (Darwin, 2001). Impulsivity, a common personality trait in highly reactive individuals, has also been shown to contribute to substance misuse. Effective emotional management allows individuals to employ adaptive coping strategies in high-risk situations, while those with higher emotional regulation tend to better understand others' intentions, perceive external pressures, and control their emotions, thereby resisting substance use (Terzis & Revi, 2014). Consequently, cognitive-emotional regulation deficits are a core issue among substance users, leading to impaired emotional control and higher substance use propensity. Emotional reactivity, combined with ineffective negative emotion regulation strategies, significantly elevates the risk of substance misuse. Individuals with low emotional reactivity or poor self-regulation are more likely to seek substances as a quick method to manage stress and regulate emotions (Ali Hossein Maslak & Kiani, 2021; Mosavi Nasab & Bahrami, 2021).

Despite the valuable findings, this study has several limitations. First, the cross-sectional design prevents causal inferences, limiting our ability to conclude that emotional reactivity directly causes increased substance use. Second, data collection relied on self-report measures, which may be subject to social desirability bias or inaccurate recall. Third, the sample was restricted to students from specific regions, which limits the generalizability of the findings to other populations or age

groups. Additionally, some contextual factors, such as peer influence, family environment, and socio-economic status, were not considered, which may also affect substance use behaviors.

Future research should employ longitudinal or experimental designs to better establish causal relationships between emotional reactivity, emotion regulation strategies, and substance use. Intervention programs aiming to enhance emotional self-regulation and coping skills may be effective in reducing the risk of substance misuse, particularly among highly reactive individuals. Practitioners and educators should focus on developing emotional awareness, impulse control, and adaptive coping strategies in adolescents and young adults to strengthen their resistance to substance-related temptations. Moreover, integrating emotional regulation training into school curricula or preventive programs may provide a proactive approach to mitigating substance use tendencies in vulnerable populations.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by ethics committee of Islamic Azad University.

Author contributions

All authors contributed to the study conception and design, material preparation, data collection and analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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