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The Effectiveness of Mindfulness Training on Cognitive Flexibility and Assertiveness in Individuals with Substance Use Disorder

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A B S T R A C T

Purpose: The present study aimed to investigate the effectiveness of mindfulness training on cognitive flexibility and assertiveness among individuals with substance use disorder in the city of Sari.

Methods and Materials: The present study employed a quasi-experimental design with a pretest–posttest structure and a non-equivalent control group. The statistical population consisted of all male opioid substance users aged 20 to 50 years who had active records in five addiction treatment centers in Sari during 2025. After administering the Cognitive Flexibility Questionnaire, 30 individuals who obtained scores lower than the cutoff point of 70 were selected through simple random sampling and randomly assigned into an experimental group (n = 15) and a control group (n = 15). Data collection instruments included the Cognitive Flexibility Questionnaire developed by Dennis and Vander Wal (2010) and the Assertiveness Questionnaire developed by Cutler and Guerra (1976). The experimental group participated in eight 60-minute mindfulness training sessions based on the protocol of Kabat-Zinn (2003), whereas the control group received no intervention. Data were analyzed using descriptive statistics, multivariate analysis of covariance, and univariate analysis of covariance through SPSS version 22.

Findings: The findings indicated that the assumptions underlying multivariate analysis of covariance were satisfied, including normal distribution, homogeneity of variances, and homogeneity of regression slopes. The results of multivariate analysis of covariance demonstrated a statistically significant difference between the experimental and control groups in the combined dependent variables, $F(2, 25) = 46.94$, $p < 0.01$. Furthermore, univariate covariance analyses revealed that mindfulness training had a statistically significant effect on cognitive flexibility, $F(1, 27) = 91.27$, $p < 0.01$, $\eta^2 = 0.778$, and assertiveness, $F(1, 27) = 65.51$, $p < 0.01$, $\eta^2 = 0.716$. The results showed that mindfulness training produced greater effectiveness in improving cognitive flexibility compared with assertiveness.

Conclusion: The findings of the present study demonstrated that mindfulness training is an effective psychological intervention for enhancing cognitive flexibility and assertiveness among individuals with substance use disorder.

Keywords: *Cognitive flexibility, assertiveness, mindfulness, substance use disorder.*

1. Introduction

Substance use disorder is considered one of the most significant psychological, social, and public health challenges worldwide. The chronic and relapsing nature of substance abuse not only affects physical health but also disrupts emotional regulation, cognitive functioning, interpersonal relationships, and social adaptation. Individuals with substance use disorder frequently experience impaired executive functioning, emotional dysregulation, impulsivity, social withdrawal, and reduced psychological adaptability, all of which contribute to the persistence of addictive behaviors and increased vulnerability to relapse (Sharma et al., 2021). Recent psychological research has increasingly emphasized that addiction should not be viewed solely as a biological or behavioral phenomenon, but rather as a multidimensional disorder involving complex cognitive, emotional, and social mechanisms. Among the psychological variables associated with substance use disorder, cognitive flexibility and assertiveness have received considerable attention because of their important roles in adaptive functioning, self-regulation, and interpersonal effectiveness (Kupis et al., 2021; Tanhan et al., 2024).

Cognitive flexibility refers to the capacity to modify cognitive strategies, adapt to changing environmental demands, and generate alternative solutions in response to difficult situations. It enables individuals to shift perspectives, reconsider maladaptive beliefs, and engage in adaptive problem-solving processes. Cognitive flexibility is considered a central component of executive functioning and psychological resilience, facilitating adjustment in stressful and uncertain situations (Kupis et al., 2021). Individuals with low cognitive flexibility often demonstrate rigid thinking patterns, impaired decision-making, emotional dysregulation, and difficulty adapting to environmental changes, all of which may contribute to the initiation and maintenance of addictive behaviors. Research has shown that deficits in cognitive flexibility are associated with a variety of psychological disorders, including anxiety disorders, depression, eating disorders, and behavioral addictions (Miles et al., 2020; Miles et al., 2021). In the context of substance abuse, cognitive rigidity may prevent individuals from adopting healthier coping strategies and increase dependence on substances as a maladaptive mechanism for emotional regulation.

Recent studies have highlighted the importance of cognitive flexibility in promoting psychological well-being and adaptive social functioning. For example, Tanhan et al. demonstrated that cognitive flexibility mediates the relationship between problematic social media use and maladaptive interpersonal behaviors, indicating that individuals with greater cognitive flexibility are more capable of adaptive emotional and social adjustment (Tanhan et al., 2024). Similarly, Rastelli et al. found that interventions designed to alter perceptual and cognitive experiences can significantly enhance cognitive flexibility and creative thinking (Rastelli et al., 2022). In educational and developmental contexts, cognitive flexibility has also been linked to improved self-regulation, creativity, and adaptive learning outcomes (Atrup et al., 2023). Furthermore, Mohammadi et al. reported that psychological interventions grounded in cognitive and behavioral principles significantly improved psychological flexibility among children with separation anxiety disorder (Mohammadi et al., 2022). Bayatiani et al. likewise found that cognitive-behavioral play therapy enhanced cognitive flexibility in students with learning disabilities and attention-deficit/hyperactivity disorder (Bayatiani et al., 2020). These findings collectively suggest that cognitive flexibility is a modifiable psychological construct that can be strengthened through therapeutic interventions.

Another important psychological variable associated with successful adaptation and recovery from substance use disorder is assertiveness. Assertiveness refers to the ability to express one's thoughts, emotions, rights, and needs in a direct, respectful, and socially appropriate manner. Assertive individuals are generally more capable of setting interpersonal boundaries, resisting social pressure, and communicating effectively without aggression or passivity (Darjan et al., 2020). Low assertiveness has been associated with social anxiety, emotional suppression, reduced self-esteem, interpersonal dependency, and vulnerability to peer pressure, all of which may increase the likelihood of substance abuse and relapse. In contrast, assertiveness enables individuals to reject maladaptive social influences and engage in healthier interpersonal interactions.

Empirical evidence has demonstrated that assertiveness training contributes to psychological well-being and improved social functioning across different populations. Parray et al. found that assertiveness training significantly increased assertiveness and self-esteem among adolescents, emphasizing its role in promoting emotional adjustment and social competence (Parray et al., 2020). Lu et al. reported that low assertiveness negatively influenced academic and professional performance among East Asian students in law

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and business schools, while environments that encouraged communication and participation improved performance outcomes (Lu et al., 2022). Darjan et al. also emphasized that assertiveness is a critical distinguishing factor between adaptive self-expression and maladaptive interpersonal behaviors such as bullying (Darjan et al., 2020). In the context of addiction treatment, assertiveness is particularly important because individuals with substance use disorder often struggle with interpersonal pressure, impaired self-confidence, and difficulty expressing emotional needs in adaptive ways.

Mindfulness has emerged as one of the most effective contemporary psychological interventions for improving cognitive and emotional functioning. Mindfulness refers to purposeful, nonjudgmental awareness of present-moment experiences, including thoughts, emotions, bodily sensations, and environmental stimuli. Mindfulness-based interventions encourage individuals to observe internal experiences without avoidance, suppression, or impulsive reaction, thereby promoting emotional regulation, cognitive awareness, and psychological flexibility (Büyüköksüz & Kayaalp-pehlivan, 2025; Oliveira et al., 2025). The theoretical foundations of mindfulness suggest that greater awareness and acceptance of present experiences reduce automatic maladaptive responses and facilitate more adaptive cognitive and behavioral patterns.

A growing body of literature supports the effectiveness of mindfulness interventions in enhancing cognitive flexibility. Ay found a positive relationship between mindfulness, self-regulation, and cognitive flexibility among university students, suggesting that mindfulness practices facilitate adaptive cognitive processing and emotional control (Ay, 2023). Wen et al. similarly demonstrated that mindfulness contributes to reductions in stress and anxiety through mediating mechanisms such as cognitive flexibility and self-awareness (Wen et al., 2021). Zhang et al. reported that mindfulness significantly reduced shame among adults and that cognitive flexibility served as a mediating mechanism in this relationship (Zhang et al., 2025). Likewise, Beyazıt et al. showed that mindfulness and cognitive flexibility are interconnected through social-cognitive mechanisms such as theory of mind, highlighting the broader interpersonal benefits of mindfulness practices (Beyazıt et al., 2025). Büyüköksüz and Kayaalp-Pehlivan further demonstrated that mindfulness indirectly reduced anxiety through improvements in emotional regulation and psychological flexibility (Büyüköksüz & Kayaalp-pehlivan, 2025).

Research has also shown that mindfulness-based interventions can improve cognitive functioning and reduce maladaptive emotional responses in clinical populations. Charness et al. found that mindfulness training improved cognitive performance while simultaneously reducing stress levels (Charness et al., 2024). Fakourian reported that mindfulness-based therapy significantly enhanced cognitive flexibility among individuals with gender dysphoria (Fakourian, 2024). Similarly, Fazouni and Rezaei Bousari demonstrated that mindfulness training improved cognitive flexibility and reduced occupational burnout among customs employees (Fazouni & Rezaei Bousari, 2024). Shojaeian et al. compared mindfulness-based cognitive behavioral therapy with emotion-focused therapy among adolescents with internet addiction and found significant improvements in cognitive flexibility following mindfulness intervention (Shojaeian et al., 2023). These studies collectively indicate that mindfulness interventions can strengthen adaptive cognitive processes across diverse populations and psychological conditions.

In addition to cognitive flexibility, mindfulness appears to have substantial effects on assertiveness and interpersonal competence. Yaghoubi et al. demonstrated that mindfulness and assertiveness training reduced social anxiety and enhanced assertiveness among participants (Yaghoubi et al., 2014). Similarly, Yousefi Saeedabadi and Radmerikhi found that mindfulness-based stress reduction significantly improved assertiveness and social competence among school principals (Yousefi Saeedabadi & Radmerikhi, 2023). Salmani Binabaj also reported that mindfulness training effectively increased assertiveness among female high school students (Salmani Binabaj, 2024). Kulshreshtha et al. proposed a mindfulness and assertiveness model for managing emotional problems among adolescents and emphasized that mindfulness practices enhance emotional regulation and interpersonal confidence (Kulshreshtha et al., 2022). Furthermore, Muspitha et al. found that mindfulness-based cognitive behavioral therapy combined with assertiveness training reduced postpartum depression and improved psychological adjustment among mothers (Muspitha et al., 2023). These findings suggest that mindfulness can strengthen individuals' capacity for adaptive interpersonal communication and self-expression.

The relationship between mindfulness and psychological flexibility has also been extensively discussed in recent theoretical and empirical literature. Oliveira et al. emphasized that mindfulness reduces psychological inflexibility and maladaptive emotional responses among

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adolescent athletes (Oliveira et al., 2025). Psychological flexibility enables individuals to tolerate distress, adapt to challenging situations, and pursue valued goals despite difficult emotional experiences. Substance use disorder is often characterized by avoidance-based coping and psychological rigidity, making mindfulness-based approaches particularly relevant for addiction treatment. By increasing present-moment awareness and decreasing experiential avoidance, mindfulness may help individuals with substance use disorder develop healthier coping mechanisms and more adaptive behavioral responses.

Despite the growing evidence regarding the effectiveness of mindfulness interventions, relatively limited research has simultaneously examined the effects of mindfulness training on both cognitive flexibility and assertiveness among individuals with substance use disorder. Most previous studies have focused either on cognitive functioning or interpersonal outcomes independently, and few have specifically targeted opioid-dependent populations. Moreover, substance abuse treatment programs often prioritize detoxification and pharmacological management while giving comparatively less attention to cognitive and interpersonal rehabilitation. Considering that impaired cognitive flexibility and low assertiveness may contribute to relapse vulnerability, treatment resistance, and maladaptive social functioning, interventions aimed at improving these psychological capacities may play an important role in comprehensive addiction treatment.

From a methodological perspective, quasi-experimental designs with pretest–posttest structures and control groups provide valuable opportunities for evaluating the effectiveness of psychological interventions in clinical settings (Delavar, 2020). Such designs allow researchers to assess changes attributable to interventions while accounting for baseline differences between groups. Given the increasing emphasis on evidence-based psychological interventions in addiction treatment, further empirical investigation into mindfulness-based approaches appears necessary, particularly within culturally diverse contexts and among individuals with opioid substance use disorder.

Considering the theoretical significance of cognitive flexibility and assertiveness in psychological adaptation, the demonstrated effectiveness of mindfulness-based interventions in improving cognitive and emotional functioning, and the limited research focusing on individuals with substance use disorder, the present study aimed to investigate the effectiveness of mindfulness training on cognitive flexibility and assertiveness among individuals with substance use disorder in the city of Sari.

2. Methods and Materials

2.1. Study Design and Participants

The present study employed a quasi-experimental design with a pretest–posttest structure and a non-equivalent control group. The members of the two groups were not individually matched. The statistical population consisted of all male opioid substance users, including users of opium, morphine, codeine, and heroin, aged between 20 and 50 years who had active records in five addiction treatment centers in the city of Sari during 2025. Based on the recommendation of methodological experts regarding the adequacy of 15 participants per group in intervention-based studies, the sampling procedure was conducted in several stages. Initially, the Cognitive Flexibility Questionnaire was distributed among all eligible substance users. Among 80 individuals who obtained scores below the cutoff point of 70 on the Cognitive Flexibility Questionnaire, 30 participants were selected through simple random sampling and randomly assigned into an experimental group (n = 15) and a control group (n = 15).

The inclusion criteria included opioid substance abuse, age range between 20 and 50 years, at least one year of substance use history, a maximum of one month since referral to the addiction treatment center, obtaining a score below 70 on the Cognitive Flexibility Questionnaire, male gender, residence in the city of Sari, absence of diagnosed comorbid psychological or physical disorders, and willingness to participate in the study through signing informed consent forms. The exclusion criteria included obtaining a score higher than 70 on the Cognitive Flexibility Questionnaire, failure to meet the inclusion criteria at any stage of the intervention, incomplete completion of the questionnaires, absence from more than two intervention sessions, and unwillingness to continue participation in the study. Ethical considerations observed in the present study included obtaining the necessary permissions from the university and the research deputy, acquiring written informed consent from participants, emphasizing the voluntary nature of participation, ensuring confidentiality of information and its exclusive use for research purposes, maintaining participants' privacy, adhering to the principle of benefit over harm, commitment to compensating any potential harm, avoiding bias in participant selection, and

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ensuring the absence of conflicts of interest among the researchers.

2.2. Measures

The Cognitive Flexibility Questionnaire developed by Dennis and Vander Wal (2010) was used to assess participants' cognitive flexibility. This questionnaire consists of 20 items designed to evaluate individuals' progress in both clinical and non-clinical settings and to assess the development of flexible thinking in cognitive-behavioral treatment for depression and other psychological disorders. Previous studies conducted in Iran identified three subscales for this instrument, including alternatives, control, and alternatives for human behavior. The questionnaire is scored based on a seven-point Likert scale ranging from strongly agree (7) to strongly disagree (1). Subscale scores are obtained by summing the relevant items, and the total score is calculated by summing all questionnaire items. Total scores range from 20 to 140, with a cutoff point of 70 indicating adequate cognitive functioning. Higher scores reflect greater levels of cognitive flexibility. Dennis and Vander Wal (2010) confirmed the construct and concurrent validity of the questionnaire, and the reliability coefficients obtained through Cronbach's alpha were reported as 0.88 for alternatives, 0.89 for control, 0.90 for alternatives for human behavior, and 0.91 for the total scale. In Iran, Soltani et al. confirmed the construct and content validity of the questionnaire and reported a Cronbach's alpha coefficient of 0.90.

Assertiveness was assessed using the Assertiveness Questionnaire developed by Cutler and Guerra (1976). This instrument contains 20 items designed to measure assertive behaviors and interpersonal confidence. Responses are rated on a four-point Likert scale ranging from never (1) to mostly (4), with higher scores indicating greater assertiveness. The developers confirmed the construct and convergent validity of the questionnaire, and reliability coefficients obtained through Cronbach's alpha for the subscales were reported to be approximately 0.88. In Iranian research, Ghazanfari and Rezaei confirmed the construct validity of the instrument and reported a Cronbach's alpha coefficient of 0.80 for the total scale, indicating satisfactory internal consistency.

2.3. Intervention

The mindfulness training program used in the present study was adapted from the mindfulness-based intervention developed by Kabat-Zinn (2003). The intervention was administered to the experimental group in eight weekly sessions, each lasting approximately 60 minutes, while the control group received no intervention during the study period. The sessions included introduction to mindfulness concepts, orientation regarding the objectives and structure of the intervention, and familiarization among participants. Subsequent sessions focused on relaxation training, meditation exercises, breathing awareness, mindful observation of bodily sensations, and body scan techniques. Participants were also trained to increase awareness of thoughts and emotions without judgment, recognize the interaction between thoughts and feelings, and replace negative thoughts with more adaptive and positive cognitions. Additional components included communication style training, concentration on bodily feelings and life achievements, coping strategies, guided imagery, and the importance of healthy lifestyle practices such as nutrition. Continuous meditation and breathing exercises were incorporated throughout the intervention to strengthen mindfulness skills and emotional self-regulation.

2.4. Data Analysis

Data analysis was conducted using both descriptive and inferential statistical methods. Descriptive statistics included mean, standard deviation, skewness, and kurtosis indices to summarize the characteristics of the data. Inferential statistics were performed using univariate and multivariate analysis of covariance (ANCOVA and MANCOVA) in order to examine the effects of the mindfulness intervention on cognitive flexibility and assertiveness while controlling for pretest scores. All statistical analyses were performed using SPSS software version 22, and the significance level was set at 0.01.

3. Findings and Results

The demographic findings indicated that in the experimental group, 66.7% of the participants were between 20 and 35 years of age and 33.3% were between 36 and 50 years old, whereas in the control group, 60% were between 20 and 35 years old and 40% were between 36 and 50 years old. Regarding educational level, 53.3% of the participants in the experimental group and 66.7% in the control group had education below a diploma degree, while 46.7% of the experimental group and 33.3% of the control group had a diploma degree. In terms of substance type, opium was the most frequently used substance in both groups, followed by morphine, codeine, and heroin. Additionally, 53.3% of the

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participants in both groups had a substance use duration of one to five years, whereas 46.7% had a history of substance use of six years or more. The results of the chi-square tests revealed no statistically significant differences between the experimental and control groups in demographic variables, including age, educational level, type of substance used, and duration of use ($p > 0.05$), indicating that the two groups were homogeneous with respect to demographic characteristics.

Table 1

Means and Standard Deviations of Cognitive Flexibility and Assertiveness Scores in the Experimental and Control Groups

Variable	Test Stage	Experimental Group Mean	Experimental Group SD	Control Group Mean	Control Group SD
Cognitive Flexibility	Pretest	60.51	10.37	60.26	8.13
Cognitive Flexibility	Posttest	87.53	7.96	60.83	6.79
Assertiveness	Pretest	30.34	3.52	20.24	3.41
Assertiveness	Posttest	43.27	5.25	20.55	3.37

The descriptive findings presented in Table 1 demonstrate that the mean scores of cognitive flexibility and assertiveness increased substantially in the experimental group from pretest to posttest, whereas only negligible changes were observed in the control group. Specifically, the mean score of cognitive flexibility in the experimental group increased from 60.51 (SD = 10.37) at pretest to 87.53 (SD = 7.96) at posttest, while in the control group the mean score changed only slightly from 60.26 (SD = 8.13) to 60.83 (SD = 6.79). Similarly, the mean assertiveness score in the experimental group increased from 30.34 (SD = 3.52) at pretest to 43.27 (SD = 5.25) at posttest, whereas the control group showed minimal change from 20.24 (SD = 3.41) to 20.55 (SD = 3.37). These descriptive findings suggest that mindfulness training was associated with improvements in both cognitive flexibility and assertiveness among individuals with substance use disorder.

Examination of the assumptions underlying multivariate analysis of covariance indicated that the statistical assumptions were adequately satisfied. The results of the Shapiro–Wilk test for the pretest and posttest scores of cognitive flexibility and assertiveness in both the experimental and control groups were non-significant, indicating normal distribution of the variables. Furthermore, the results of Box's M test, Levene's test, and the homogeneity of regression slopes analysis revealed significance levels greater than 0.05, confirming the assumptions of homogeneity of covariance matrices, equality of variances, and homogeneity of regression slopes across groups. Therefore, the assumptions required for conducting multivariate analysis of covariance (MANCOVA) were met. The multivariate analysis demonstrated significant group differences across the combined dependent variables. Pillai's Trace = 0.790, Wilks' Lambda = 0.210, Hotelling's Trace = 3.755, and Roy's Largest Root = 3.755 were all statistically significant at the 0.01 level, $F(2, 25) = 46.94$, $p < 0.01$, indicating that there was a significant difference between the experimental and control groups on at least one of the dependent variables.

Table 2

Results of Multivariate Analysis of Covariance on Cognitive Flexibility and Assertiveness

Source	Variable	Sum of Squares	df	Mean Square	F	p	Effect Size	Statistical Power
Group	Cognitive Flexibility	5344.44	1	5344.44	91.27	0.01	0.778	1.00
Group	Assertiveness	1202.31	1	1202.31	65.51	0.01	0.716	1.00

As shown in Table 2, the results of the multivariate analysis of covariance indicated statistically significant differences between the experimental and control groups in cognitive flexibility and assertiveness at the posttest stage after controlling for pretest scores. The intervention had a significant effect on cognitive flexibility, $F(1, 27) = 91.27$, $p < 0.01$, with an effect size of 0.778, indicating a strong effect of mindfulness training on improving cognitive flexibility among individuals with substance use disorder. Similarly, mindfulness training had a statistically significant effect on assertiveness, $F(1, 27) = 65.51$, $p < 0.01$, with an effect size of 0.716. The obtained statistical power for both variables was 1.00, indicating adequate sensitivity of the statistical analysis. Overall, these findings demonstrate that

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mindfulness training was effective in enhancing both cognitive flexibility and assertiveness among individuals with substance use disorder in the city of Sari, with a stronger effect observed for cognitive flexibility.

4. Discussion and Conclusion

The present study aimed to investigate the effectiveness of mindfulness training on cognitive flexibility and assertiveness among individuals with substance use disorder in the city of Sari. The findings demonstrated that mindfulness training significantly improved both cognitive flexibility and assertiveness in the experimental group compared with the control group. Furthermore, the results indicated that the intervention had a stronger effect on cognitive flexibility than on assertiveness. These findings suggest that mindfulness-based interventions can play a substantial role in improving adaptive cognitive and interpersonal functioning among individuals struggling with substance use disorder.

One of the major findings of the present study was the significant increase in cognitive flexibility among participants who received mindfulness training. This finding is consistent with previous studies emphasizing the positive relationship between mindfulness and adaptive cognitive functioning (Ay, 2023; Wen et al., 2021; Zhang et al., 2025). Mindfulness training encourages individuals to become consciously aware of their thoughts, emotions, and behavioral responses without engaging in immediate judgment or impulsive reaction. Through repeated mindfulness practices, individuals gradually learn to observe their internal experiences from multiple perspectives, which may weaken rigid cognitive patterns and increase mental adaptability. Since individuals with substance use disorder often exhibit cognitive rigidity, impulsive thinking, and maladaptive coping strategies, mindfulness may facilitate more flexible cognitive processing and improve the ability to evaluate situations from alternative viewpoints.

The improvement in cognitive flexibility observed in the present study is also aligned with the theoretical assumptions of executive functioning and self-regulation. Cognitive flexibility is considered a central component of executive functioning that enables individuals to modify cognitive strategies in response to environmental changes and stressful situations (Kupis et al., 2021). Substance abuse is frequently associated with impairments in executive functioning, emotional dysregulation, and repetitive maladaptive behaviors. Mindfulness practices may improve attentional control and awareness of cognitive processes, thereby enabling individuals to interrupt automatic maladaptive patterns and adopt more adaptive responses. This interpretation is supported by the findings of Charness et al., who demonstrated that mindfulness training enhances cognitive performance and reduces stress levels (Charness et al., 2024). Similarly, Shojaeian et al. found that mindfulness-based cognitive behavioral therapy significantly improved cognitive flexibility among adolescents with internet addiction (Shojaeian et al., 2023). The consistency between these findings and the results of the present study suggests that mindfulness interventions may exert their effects across different forms of addiction and maladaptive behavioral patterns.

Another explanation for the increase in cognitive flexibility may relate to the role of mindfulness in reducing experiential avoidance and promoting present-moment awareness. Individuals with substance use disorder often use substances as a maladaptive strategy to escape unpleasant emotions, intrusive thoughts, or stressful situations. Mindfulness encourages acceptance of internal experiences rather than avoidance or suppression, thereby reducing emotional reactivity and increasing tolerance for distressing experiences. Oliveira et al. emphasized that mindfulness reduces psychological inflexibility and maladaptive emotional responses by promoting acceptance-based coping strategies (Oliveira et al., 2025). Likewise, Büyüköksüz and Kayaalp-Pehlivan found that mindfulness indirectly reduced anxiety through improvements in emotional regulation and psychological flexibility (Büyüköksüz & Kayaalp-pehlivan, 2025). These findings support the idea that mindfulness enhances cognitive flexibility by helping individuals disengage from rigid patterns of thought and respond more adaptively to emotional challenges.

The findings of the present study are also consistent with research indicating that cognitive flexibility can be enhanced through structured psychological interventions. Bayatiani et al. reported that cognitive-behavioral play therapy and theory of mind training improved cognitive flexibility among students with learning disabilities and attention-deficit/hyperactivity disorder (Bayatiani et al., 2020). Mohammadi et al. similarly demonstrated that cognitive and behavioral interventions enhanced psychological flexibility in children with separation anxiety disorder (Mohammadi et al., 2022). Fakourian also found that mindfulness-based therapy significantly improved cognitive flexibility among individuals with gender dysphoria (Fakourian, 2024). Together, these findings indicate that cognitive flexibility is

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not a fixed characteristic but rather a modifiable psychological process that can be strengthened through targeted therapeutic interventions.

The present findings also demonstrated that mindfulness training significantly increased assertiveness among individuals with substance use disorder. This finding is consistent with previous studies that identified mindfulness as an effective approach for improving interpersonal functioning, emotional expression, and social competence (Salmani Binabaj, 2024; Yaghoubi et al., 2014; Yousefi Saeedabadi & Radmerikhi, 2023). Assertiveness refers to the ability to communicate one's thoughts, needs, and emotions openly and respectfully while maintaining interpersonal boundaries. Individuals with substance use disorder often struggle with low self-esteem, emotional suppression, interpersonal dependency, and susceptibility to peer pressure, all of which may reduce assertive behavior and contribute to continued substance use. Mindfulness practices may improve assertiveness by increasing emotional awareness, self-acceptance, and confidence in interpersonal interactions.

One possible explanation for this finding is that mindfulness training promotes nonjudgmental awareness and emotional regulation, which may reduce fear of rejection and social evaluation. Individuals who become more aware of their emotional experiences and less reactive to negative self-evaluations may feel more capable of expressing their opinions and needs assertively. Kulshreshtha et al. proposed that mindfulness enhances emotional regulation and interpersonal confidence, thereby contributing to improved assertiveness among adolescents experiencing emotional difficulties (Kulshreshtha et al., 2022). Similarly, Muspitha et al. found that mindfulness-based cognitive behavioral therapy combined with assertiveness training reduced postpartum depression and improved interpersonal adjustment (Muspitha et al., 2023). These findings support the interpretation that mindfulness can improve assertiveness by strengthening emotional awareness and adaptive communication skills.

The improvement in assertiveness may also be related to increased self-regulation and self-awareness resulting from mindfulness practices. Mindfulness interventions encourage individuals to become more conscious of their emotional states, behavioral impulses, and interpersonal reactions. This heightened awareness may help individuals respond more intentionally rather than react impulsively or passively during social interactions. Ay found that mindfulness was positively associated with self-regulation and cognitive flexibility among university students (Ay, 2023). Wen et al. also demonstrated that mindfulness contributes to reductions in stress and anxiety through mechanisms involving cognitive flexibility and self-awareness (Wen et al., 2021). Since assertive behavior often requires emotional control and reflective thinking, improvements in self-regulation may partially explain the increase in assertiveness observed in the present study.

The present findings are also consistent with the broader literature emphasizing the importance of assertiveness in psychological adjustment and adaptive functioning. Parray et al. reported that assertiveness training significantly improved assertiveness and self-esteem among adolescents (Parray et al., 2020). Lu et al. similarly emphasized that low assertiveness negatively affects academic and professional functioning, whereas environments promoting participation and communication improve performance outcomes (Lu et al., 2022). Darjan et al. highlighted that assertiveness serves as an important protective factor against maladaptive interpersonal behaviors and social vulnerability (Darjan et al., 2020). Within the context of substance use disorder, assertiveness may help individuals resist social pressure, communicate personal boundaries, and seek support more effectively during recovery processes.

Another important finding of the present study was that mindfulness training appeared to exert a stronger effect on cognitive flexibility than on assertiveness. This finding may be explained by the cognitive nature of mindfulness-based interventions. Mindfulness training primarily targets attentional processes, cognitive awareness, and emotional observation, all of which are directly associated with cognitive flexibility. Through meditation exercises, body scanning, and awareness practices, participants repeatedly engage in cognitive shifting, attentional control, and acceptance-based thinking patterns. Consequently, mindfulness may produce more immediate and direct changes in cognitive functioning compared with interpersonal behavioral patterns such as assertiveness, which may require longer periods of practice and social reinforcement to become fully integrated into daily interactions.

The results of the present study also support contemporary theoretical perspectives emphasizing the interconnected relationship between mindfulness, cognitive flexibility, and adaptive psychological functioning. Zhang et al. demonstrated that mindfulness reduces maladaptive emotional experiences through cognitive flexibility and self-compassion mechanisms (Zhang et al., 2025). Beyazıt et al.

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likewise found that mindfulness and cognitive flexibility are linked through social-cognitive mechanisms such as theory of mind (Beyazıt et al., 2025). These findings suggest that mindfulness may enhance psychological adaptation through multiple interconnected pathways involving emotional regulation, cognitive restructuring, and interpersonal awareness. For individuals with substance use disorder, such improvements may contribute to healthier coping strategies, reduced emotional avoidance, and increased resilience against relapse.

Furthermore, the findings of the present study have practical implications for addiction treatment programs. Traditional approaches to addiction treatment often focus primarily on detoxification and pharmacological management while giving comparatively less attention to cognitive and interpersonal rehabilitation. However, deficits in cognitive flexibility and assertiveness may significantly interfere with long-term recovery and relapse prevention. The findings of this study suggest that incorporating mindfulness-based interventions into addiction treatment settings may help individuals develop more adaptive cognitive strategies, improve emotional regulation, and strengthen interpersonal competence. Given the chronic and multifaceted nature of substance use disorder, integrating mindfulness training into rehabilitation programs may provide a more comprehensive and psychologically informed approach to treatment.

The findings should also be interpreted in light of methodological considerations associated with quasi-experimental research designs. Delavar emphasized that pretest–posttest designs with control groups provide useful opportunities for evaluating intervention effectiveness in applied psychological settings (Delavar, 2020). The use of a control group and statistical control of pretest scores through covariance analysis strengthened the internal validity of the present findings. Additionally, the high statistical power and substantial effect sizes observed in the present study further support the effectiveness of mindfulness training in improving cognitive flexibility and assertiveness among individuals with substance use disorder.

One limitation of the present study was the relatively small sample size and the restriction of participants to male opioid users in the city of Sari, which may limit the generalizability of the findings to other populations, genders, and cultural contexts. Another limitation was the use of self-report questionnaires, which may have been influenced by social desirability bias or inaccurate self-perceptions. In addition, the absence of a follow-up phase prevented examination of the long-term stability of the intervention effects. The quasi-experimental design and lack of individual matching between groups may also have influenced the results despite statistical control procedures.

Future research is recommended to examine the long-term effectiveness of mindfulness-based interventions through follow-up assessments conducted several months after treatment completion. Researchers may also compare mindfulness training with other therapeutic approaches such as cognitive-behavioral therapy, acceptance and commitment therapy, or dialectical behavior therapy in individuals with substance use disorder. Expanding research to include female participants, adolescents, and individuals with different forms of substance dependence would improve the generalizability of findings. Additionally, future studies may investigate mediating variables such as emotional regulation, self-compassion, resilience, and social support to better understand the mechanisms underlying the effectiveness of mindfulness interventions.

From a practical perspective, the findings suggest that mindfulness training can be incorporated into addiction treatment and rehabilitation programs as an effective complementary intervention for improving cognitive flexibility and assertiveness. Counselors, psychologists, and addiction treatment specialists may utilize mindfulness-based techniques to help individuals become more aware of maladaptive thought patterns and develop healthier coping strategies. Rehabilitation centers may also benefit from integrating structured mindfulness sessions into group treatment programs to improve emotional regulation, interpersonal communication, and relapse prevention. Furthermore, educational workshops focused on mindfulness and assertiveness skills may assist individuals with substance use disorder in strengthening self-confidence, adaptive decision-making, and social functioning during recovery.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

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

Transparency Statement

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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

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the study and participated in the research with informed consent.

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