



## Effect of mindfulness-based cognitive therapy and intellectual-motor exercises in craving beliefs among industrial substance abusers

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Original Article

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### Abstract

Substance abuse disorders are considered to comprise the fourth class of diseases. The aim of the present study was to investigate the effectiveness of the multidimensional treatment procedure comprising mindfulness-based cognitive therapy, exercises (chess, ping pong), and daily self-monitoring reports. This study conducted on 40 drug abusers who were selected using convenience sampling method. They were next randomly assigned into 4 groups. Group 1 received play therapy and mindfulness; group 2 received mindfulness, play therapy, and self-monitoring reports; group 3 received mindfulness; while group 4 was the control one. Over a period of two months, the participants went through a program that comprised mindfulness treatment, play therapy, along with self-monitoring reports after mindfulness sessions. Each of these groups was affected by different interventions. Craving beliefs questionnaire was used to collect data. Based on The results, the second group experienced the least amount of craving beliefs after treatment when compared to the other groups. This finding reveals the effectiveness of mindfulness intervention combined with exercise and self-monitoring reports. Hence, mindfulness therapy and behavioral interventions (chess and ping pong) along with self-monitoring reports have a positive impact on reducing the intensity of craving beliefs in addicted individuals.

**Keywords:** Substance Abuse, Mindfulness Therapy, Exercise, Craving

### Introduction

Recent news resonates with the outbreak of a dangerous phenomenon in our society towards which cannot be ignored. Reports on the existing of millions of addicts and decreasing age of addiction have alarmed officials, researchers, and people [1]. Using methamphetamine can damage brain functions by impairing brain cells. This damage can be occurred with the symptoms

including impaired memory especially in the case of close events, disorders in attention, difficulty in moving attention across various events. By impairing the frontal region of the brain, methamphetamine deprives the individuals of having the opportunity to set a program and execute it step by step, There are a series of circuits in our brain which, in order

to damage brain circuits and create dependency and compulsion to use drugs, instinctively drive a person to eat, drink, and adopt sexual behaviors. Methamphetamine takes control of these circuits and causes the person to show an “uncontrollable craving” and an “irresistible drive to consumption” [1,2]. In short, industrial substance abuse leads to a number of changes in and impairments to the brain. Hence, providing suitable methods for strengthening the power of a logical thinking, reasoning, as well as recovering brain and mental functioning, along with some exercises to control and modulate emotional states and conscious recognition can play a significant role in relapse prevention and the treatment of addiction and its associated complications.

With respect to the aspects of the cognitive, behavioral, and mood-related considerations, along with its medical problems, fragmented thinking, and anti-social value-system, substance abuse is a purely personal disorder. Research and various theories related to addiction have shown that substance abuse has a multi-dimensional nature. Despite the fact that many studies have focused on a specific aspect of the topic, one may not arrive at a correct understanding regarding the development of the addiction and its consequent process of dependency without considering the many dimensions involved. Brayn et al. have demonstrated that not only empowering addicts to amend their irrational beliefs but also non-relapse into substance abuse are of the most crucial ways of preventing and treating addiction. Different theorists have considered habitual and thoughtless behaviors and substance symptoms orientation as important factors in the etiology substance abuse and relapse of compulsory behaviors [2]. The major problem is how and what strategies can be discussed in order to mitigate the above-mentioned processes (like craving beliefs) in substance abusers. This research tries to reduce the patients’ craving beliefs through mindfulness, intellectual-motor exercises, and self-monitoring. Mindfulness-based relapse prevention is a cognitive behavioral

therapy which combines traditional cognitive behavioral treatment with mindfulness meditation in order to treat substance relapse disorders. The fundamental element of mindfulness training is teaching subjects to direct their attention towards breathing to calm and focus the mind. Therefore, increased vigilance and acceptance of sensations and thoughts in highly dangerous circumstances can lead to more flexible ways of responding to situational symptoms and possibly reducing craving beliefs [3]. This is due to the fact that individuals with mindfulness freely perceive internal and external realities without distortion. They are characterized by a great strength in the face of a wide range of thoughts, emotions, and experiences whether pleasant or unpleasant [4]. Measuring mindfulness and its associated constructs by comparing its development in clinical and non-clinical groups does not have a long history. Only in recent decades, it has been gained momentum. For this reason, researchers have endeavored to examine mindfulness in relation to concepts of the pathology and fundamental concepts.

Several studies have observed that physical and psychological symptoms mitigate in drug users as a result of mindfulness-based cognitive therapy and that reducing stress by meditation and mindfulness may be a major factor in relapse prevention. Therefore, mindfulness training as one of the third wave of cognitive behavioral therapies can be considered an effective method to improve the physical and mental health in different groups of patients [5]. Studies show that about 20 to 90 percent of addicts who undergo treatment experience a relapse; besides, it has been found that the efficacy of conservative drug treatments is low unless they are supported with psychological and social interventions. In the procedures conducted to treat substance dependence disorders, cravings and uncontrollable desires during and after treatment play an important role in relapse or treatment failure. The reason in the present study we have attempted to deal with this factor as a

cognitive component is that craving beliefs are symptoms of sustaining addictive behaviors. In addition, the results have indicated the efficacy of mindfulness-based relapse prevention model in the motivation of opioid-dependent individuals [3], which implies a decrease in craving beliefs or their management. As well, research has demonstrated that individuals with mindfulness-based treatment had fewer relapses and they also showed a decrease in the duration of using alcohol and marijuana [6]. This may suggest the effectiveness of mindfulness-based treatment in alleviating cravings [7]. However, these studies either have focused on the efficacy of mindfulness treatment or have associated it with other psychological treatments having cognitive and behavioral aspects. Hence it seems that, in addition to mindfulness, other programs and therapies are necessary to sustain and promote the effectiveness of mindfulness such that it is not limited to training sessions and specific home assignments. Thus, the aim of this study was to look at mindfulness psychotherapy along with a non-cognitive behavioral treatment – exercise therapy- which is based on physical activities.

The findings of researchers suggest that the processes of learning, memory, and addiction are regulated and controlled via the same neural nutritional factors and similar intracellular signaling pathways and all of these three processes are associated with similar morphological adaptations. In this respect, the results indicate that addictive drugs affect brain processes and change the amount of neurotransmitters. Various reports and studies on the effects of addictive drugs on memory and learning have pointed to the occurrence of a cognitive disturbance (weakening of memory, verbal learning, concentration, attention, and recall) in drug addicts [8]. In general, it can be said that drug use may lead to impaired cognitive functioning (all verbal and practical intelligence mini-tests), especially damages to intellectual functioning and cognitive performance (learning new materials, cognitive flexibility, and retention skills). This kind of damaged cognitive disturbance due to substance abuse

can lead to a lack of participation in treatment, increased loss, and decreased attention to processing new information [9]. Hence, this disorder could be under the influence of undergoing mindfulness-based therapy. Mindfulness-based intervention is used as a compressed and systematic approach for relaxation, attention, and awareness whereby attention plays a fundamental role [4]. Despite the effects of mindfulness exercises on attention-related functions of the brain, it seems that substance abusers, because of its poor cognitive function compared to normal populations (as described earlier), scarcely use mindfulness-based therapy. In this regard, the results of mindfulness characteristic have shown that there is a positive relationship between mindfulness and substance abuse in normal cases while it has been observed in the case of clinical specimens that there is a relation between mindfulness reduction and taking more substance [10], which could probably reflect a weakness in attention and cognitive functioning of clinical samples.

On the other hand, Magnetic Resonance Imaging (MRI) images well indicate the effectiveness of intellectual exercises in the brain structure and function. The most recent scientific results suggest that, rather than being a mere diversion, activities such as reading, writing, and intellectual exercises have a significant impact on health and vitality of brain functions [11]. Based on the new laboratory findings, researchers have stated that there is an important relationship between frequent mental activities and structural integrity of white matter in different parts of the brain [4,8]. In this context, most studies have been focused on the physical activity of running. However, a variety of aerobic exercises has reportedly shown similar effects. These findings propose that exercise is effective on brain activities through mechanisms like increased release of some neurotransmitters such as dopamine, glutamate acetylcholine, and serotonin, as well as endogenous opioids [12]. At any rate, studies have demonstrated the effects

of exercise on memory function [11,12]. Therefore, it can be argued that by improving brain learning and memory processes, doing exercise can reduce the negative effects of addiction on learning and memory and facilitate the effectiveness of psychotherapies. Thus, it is of utmost importance that, in relapse prevention and treatment, one can use methods compensating for cognitive impairment and increasing the effectiveness of mindfulness.

Given the above-mentioned results, the present study aimed to explore the effectiveness of mindfulness-based treatment combined with exercise in reducing craving beliefs in substance abusers. Based on the studies on the treatment of substance dependence disorder, to date, no therapeutic approach alone (in types of drug therapy as well as psychotherapy) could have provided full and stable results. Consequently, there is a tendency nowadays to combine several methods in order to treat this condition. So, it is expected that exercise, by improving cognitive performance, will facilitate a more effective use of education along with better employment of mindfulness strategies among the addicts. In short, in this research an attempt has been made to exploit different supplementary parts of both the brain and the mind, through using two exercises, so as to affect positively the treatment process. In choosing ping pong, we have paid attention to enhancing the ability and coordination between the body and brain and in going for chess we have tried to consider the improvement of cognitive processes, the effect of winning and losing in these exercises, intellectual and emotional ramifications, and the way a player copes with these changes. So far, the potential supplementary effects of intellectual/ motor sport have largely been ignored on the course of cognitive therapies. In the present study, we have attempted to examine the efficacy of this dimension coupled with mindfulness-based psychotherapy. Nevertheless, there is no doubt that self-consciousness of the related patients has a major impact on the process of recovery and on their changing beliefs. For example, an individual learns through brain recovery

the procedure of neuro feedback to modify his/her brainwaves voluntarily by using feedback from the device. It seems thus that perceiving and observing one's daily reported thoughts and emotions can act as a monitor in biofeedback. This is owing to the fact that the patient actually sees the (lack of) progress that she/he had made via the reports she/he has written herself/himself. Hence, it is expected that the efficacy of the mindfulness training program combined with intellectual motor exercises will increase as also mental and practical lapses will decrease even more. In this way, the present study investigated the efficacy of mindfulness training enhanced by intellectual/motor exercises and daily self-monitoring in relapse prevention and it compares this triple procedure with the control group and with other therapeutic programs which lack the factors of self-monitoring reports and intellectual/motor exercises. The current research is to investigate the effectiveness of the multidimensional treatment procedure comprising mindfulness-based cognitive therapy, intellectual-motor exercises (chess, ping pong), and daily self-monitoring reports in reducing craving beliefs of substance abusers.

### **Method**

This was a practical research using the quasi-experimental method with pretest and posttest design with a control group. The population consisted of 40 men taking industrial substance (Methamphetamine) that had abandoned addiction for three months and were undergoing treatment in community-based treatment center of the Birjand, southeast of Iran, in 2014. The subjects had primary school, high school, or associate degree educations and were chosen after getting successfully detoxified and abandoning addiction. Inclusion criteria were as follow shaving at least primary education, having psychotic symptoms as well as physical ailments that limit performance, and a three-month period of addiction abandonment. Thirty patients were chosen from the community-based

treatment center and then randomly divided into three groups (n= 10 each) and the fourth group (the control group) was selected from the other center.

The reason for choosing two centers was the low number of research subjects in the therapeutic community center who were matched in terms of the mentioned variables of the groups. Then, they were randomly placed into one of the three ten-patient groups of 1, 2 and 3, as follow

- 1) Play therapy and mindfulness group
- 2) Mindfulness, play therapy, and self-monitoring reports group
- 3) Mindfulness group
- 4) Control group

In the experimental groups, we tried to assess the role of each respective therapeutic and/or supplementary method as well as between-group differences specifically, the following items were evaluated: comparing the role of self-monitoring between groups 1 and 2; comparing the role of intellectual/motor exercises between groups 2 and 3; comparing the role of mindfulness and play between groups 1 and 4; comparing the role of mindfulness between groups 3 and 4; and comparing the role of mindfulness coupled with intellectual/motor exercises and self-monitoring reports between groups 2 and 4. Thus, in order to reduce the probability of error type II, all of the 4 groups were examined and compared using covariance analysis to assess the main structure.

In the present study, two questionnaires were used for data collection:

*Craving beliefs questionnaire (CBQ)*: this questionnaire is a self-evaluation scale developed in 1993 by Wright and Beck; it measures beliefs related to substance temptations, that consists of 20 items scored based on a 7-point scale (from strongly agree to strongly disagree). The reliability of the questionnaire according to previous studies, has been reported to be 0.99 based on Cronbach's alpha [1].

*Daily self-monitoring reports*: In order to report their mental and emotional state more simply and more clearly, the patients were asked to rate daily their mental and emotional indices from 1 to 10 and then, using the graph form available

to them, determine the number of each index and finally connect the points so that the upward or downward movements associated with a particular index content show more vividly the improvement or deterioration of a patient's condition.

The score of 1 represents the weakest state, and the value of 10 signifies the strongest state and shows the ability of the person with regard to the questions posed. These indices include recording the experience of craving beliefs, decreasing stress intensity resulting from craving beliefs, one's ability to control negative thoughts and temptations, identifying the type and intensity of emotional experiences, one's ability to control emotions and recording successful strategies of controlling emotions and thoughts in the form of tables and reviewing its status daily by the participants and in each session by the therapist.

In this study, mindfulness-based cognitive therapy was employed in a collective way. Topics, exercises, and assignments of each session were based on the practical guidelines of mindfulness-based cognitive therapy [13]. Every session, except the first one, would begin by a formal mindfulness practice (physical inspection, sitting meditation) and it would come to an end by doing another practice of mindfulness (three-minute breathing space). After each exercise, the relevant themes and goals of the program suggested for each session (for example, automatic directing (guidance) in the first session, being in one's body in the second session, deliberately focusing awareness on breathing in the third meeting, mindfulness regarding sounds and thoughts in the fourth session, and so on) were examined with the patients.

program topics is presented in the following. Explaining the importance of living in the present moment and being in the here and now and unlocking the concept of mindfulness to members using several techniques, as well as learning to do everyday activities with meticulous attention. Understanding the distracted mind and practicing to focus

on the body, physical sensations, and focusing on the breath. Calming the distracted mind by breathing exercises, monitoring the body, sitting meditation, and exercises that bring attention back to the present moment. Learning to stay in the present moment and observe the turbulence of thoughts without running or staying away from people and events. Having full awareness of thoughts and feelings and accepting them without judgment and direct involvement.

Individuals would participate in a 90-minute session every week. At the beginning of each session, there was an overview of the practices of the previous session. After each session, the subjects were asked to reiterate at home those exercises they had conducted in groups.

Summary of mindfulness based cognitive therapy sessions is presented in the following:

Session I: The concept of automatic guidance of the brain was taught by having participants eat raisin. Afterward, based on their inner feelings and types of breathing, the subjects were taught to practice meditating body inspection.

Session II: It began by body inspection exercise. For homework, they were asked to walk with mindfulness and practice sitting meditation between ten to fifteen minutes.

Session III: We conducted seeing and hearing practice with the aim of teaching participants to be in the present instant.

Sessions IV and V: The exercises were repeated for the sake of more concentration.

Session VI: It was determined that mood and negative thoughts constrain our relationship with experience.

Session VII: The issue of relapse and the warning signs of each person were.

Session VIII: It was elaborated that practicing mindfulness assists one to attain balance in life.

Chess and ping pong: these plays were initially described as fun for the participants in groups 1 and 2. In addition, the beneficial effects of these plays were explained for patients in order to create motivation and enthusiasm for implementing them. At first, participants began with ping pong. In the first week, three sessions (each taking 30 minutes playing for a participant) were considered. In the second week, chess was

added such that it would occupy a weekly session. Initially, for the sake of convenience and more willing acceptance of treatment the participants were given the right to specify the time of the plays; yet, after one month, the researcher assumed this task. Ping pong was exactly played on Saturdays, Sundays, and Tuesdays and chess was precisely played on Mondays and Thursdays.

Ping pong was allowed for one hour per session, but the time given to chess did not exceed thirty minutes, since it necessitated more intellectual activity. Thus, it happened that sometimes this exercise came to an end without a winner or loser. This is because the main goal of chess here was to practice cognitive processes. This part of interventions (play therapy) for the first and second groups interfered in just one session, on Saturdays, along with mindfulness group therapy. Therefore, on the day which ping pong interfered with the group therapy participants (of the first and second groups) were asked to do first the games and then to participate in mindfulness sessions. During these sessions, important instructions were provided for the subjects about behavioral interventions of the play and self-monitoring. Besides, some explanations regarding the significance of applying these interventions were given to the participants. Altogether, ping pong was planned to be practiced twice a week, chess was assigned two sessions weekly (for groups 1 and 2), and mindfulness therapy procedure (for groups 1, 2, and 3) was designated once a week. Covariance analysis, after meeting the assumptions, was adopted as the statistical method. In this study, data were analyzed in two descriptive and inferential statistics. For the purpose of data analysis software SPSS-22 and analysis of covariance was used to evaluate the assumptions of research.

## Results

The age range of participants was between 20 and 40 years and the size of each group in both pretest and posttest (experimental and control groups) was 10. Data on educational backgrounds showed that the most

participants (23 individuals, 57%) had high school diploma, followed by secondary school education (10 individuals, 25%) and associate degree (7 individuals, 17%). The analysis of variance showed that the difference between the groups in terms of education was not

significant ( $F=0.35, p>0.05$ ). In the following Table 1, the mean scores of craving beliefs in posttest versus pretest are presented for all groups including 1) play and mindfulness, 2) mindfulness, self-monitoring, and play, 3) mindfulness, and 4) control.

**Table 1** The mean and standard deviation (SD) of scores of craving beliefs in pretest and posttest in the experimental and control groups

Intervention code	Group 1 (intellectual-motor exercise, and mindfulness)				Group 2 (mindfulness, intellectual-motor exercise, and self-monitoring)				Group 3 (mindfulness)				Group 4 (control)			
	Pretest		Posttest		Pretest		Posttest		Pretest		Posttest		Pretest		Posttest	
Item	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Craving beliefs	4.29	1.45	4.23	0.89	4.75	1.08	3.53	0.63	4.99	0.77	4.45	1.01	5.07	0.60	5.11	0.52

Assumptions of analysis of variance (ANOVA) to study the normal distribution of data were also examined. As the results of Shapiro-Wilk Test in Table 2 indicated there was no significant difference in the distributions of the experimental and control groups. In other words, participants belong to the same population with regard to the

majority of items and the total scores. Moreover, in terms of craving beliefs (pretest), even before training, the results demonstrated that participants were from the same population. It should be mentioned that the results of Shapiro-Wilk Test also proved the insignificance, showing that variables were distributed normally.

**Table 2** Normal test of craving beliefs

Group	Shapiro-wilk test in pretest			Item
	Statistic	Df	Sig.	
1.00	0.875	9	0.140	Craving beliefs
2.00	0.894	10	0.186	
3.00	0.951	10	0.683	
4.00	0.986	10	0.989	

ANOVA was employed to examine the efficacy of mindfulness, intellectual/motor exercises (chess and ping pong), and self-monitoring reports in the four groups: 1) play and mindfulness, 2) mindfulness, self-monitoring, and play, 3) mindfulness, and 4) control. Therefore, we first checked the assumptions of normality (using Kolmogorov-Smirnov test and Shapiro-Wilk test as their results were reported above), the regression homogeneity, and identity of the variance variables. To ensure the homogeneity of variances, we used Leven test ( $f=3.9, p>0.01$ ) and given the significance level of obtained Leven’s value which was more than 0.01, the data did not question the assumption of equality of error variance.

In addition, them interaction effect of variation and group membership variables (regression homogeneity within groups, i.e. the lack of interaction between the slope and treatment at 0.01) was not significant. It implies that the effect of participating in the program did not get combined with the existence of interaction; i.e. when the interaction was not significant, there was no considerable difference, in the case of various values of the pretest scores before training, between taking part in the program and not doing so. In addition, the dramatic reduction in the percentage of explainable variance, resulting from the removal of interactive effects, was also addressed to assess the related assumption. Since no significant

decrease was observed in the two full and additive models with regard to the percentage of explainable variance, the assumption of homogeneity of regression coefficients is

established for factor levels. Furthermore, R-square indicates the correlation between the dependent variable and variance variable. The results of ANOVA are presented in Table 3.

**Table 3** The results of ANOVA of the efficacy of the treatment program on craving beliefs

Source	Sum of squares	df	Mean of squares	f	Sig.	Eta coefficient
Corrected model	13.488 <sup>a</sup>	4	3.372	5.379	0.002	0.381
Pretest craving beliefs	0.702	1	0.702	1.120	0.297	0.031
Groups	11.785	3	3.928	6.267	0.002	0.349
Error	21.941	35	0.627			
Total	787.022					

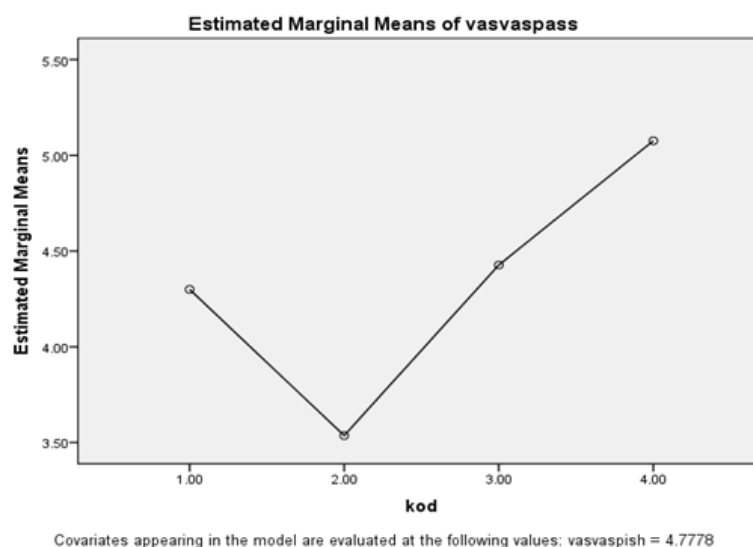
As shown in Table 4, the impact of craving beliefs ( $F=1.12$ ) at the level of  $p<0.01$  was not significant but the effect of the experimental groups' program on the intensity of craving beliefs ( $F=6.2$ ) at the level of  $p<0.002$  was significant. Thus, the difference of averages was not due to the dissimilarity of groups in the pretest. Considering Eta coefficient, one can say that after adjusting for the previous effect (35%), treatment programs can explain the variance of posttest scores. Bonferroni correction was used to interpret the differences; also, average effect of treatment was obtained by covariate after adjustment. As can be seen in the following Table 4, there was a significant difference between the adjusted averages. The results

reveal that the intensity of craving beliefs in the first group (mindfulness and exercise) and the second group (mindfulness, self-monitoring, and exercise) was significantly lower than that in the fourth group (control). The results also show that the second group (mindfulness, self-monitoring, and exercise) exhibited a much lower level of craving beliefs compared to the first group (mindfulness and exercise). This points the fact that self-monitoring has also been an influencing factor in this study. Similarly, compared to the third group (mindfulness), the second group (mindfulness, self-monitoring, and exercise) displayed a noticeably lower amount of craving beliefs, which implies the efficacy of self-monitoring and exercise.

**Table 4** The results of the difference between the adjusted mean of craving beliefs in the four groups

Groups	Difference in mean (I-J)	Standard error	Significance level	
2	0.76*	0.35	0.04	
1	3	-0.12	0.36	0.72
	4	-0.77*	0.36	0.04
2	1	-0.76*	0.35	0.04
	3	-0.89*	0.35	0.01
	4	-0.54*	0.35	0.00
	1	0.12	0.35	0.72
3	2	0.89*	0.35	0.01
	4	-0.64	0.34	0.07
4	1	0.77*	0.36	0.04
	2	1.54*	0.35	0.00
	3	0.64	0.35	0.07





**Figure 1** The mean of craving beliefs in the four groups

In figure 1 presents the averages of craving beliefs in the four groups, where, as can be seen, the second group demonstrated the lowest level.

### Discussion

The present study revealed the significant effects of mindfulness training with and without supplementary treatments on decreasing craving beliefs. Substance abuse causes various dimensions of searching and using drugs to gradually become sovereign of conscious thoughts and turn into instant and automatic processes; this automatic processing strengthens the incentive to take even more substance [14]. In therapies based on mindfulness, the mind of a person is released from mental preoccupation and past automatic responses. Also, through increasing the awareness of the individual about existing experiences and by returning the attention to the cognitive system, one can reduce unconscious information processing and thus lower past habitual strategies, and eventually look for new ways of treating situational symptoms and monitoring one's reactions to the environmental phenomena [15]. Therefore, in the method of the mindfulness due to its underlying mechanisms (such as increased awareness and acceptance of thoughts, emotions, and operational desires), regulating inner experiences, and adjusting improved adaptive behaviors one may mitigate craving beliefs [5]. As a technique of non-judgmental attention to

inner experiences, the mindfulness allows an individual to reduce his/her fears, anxieties, and ambivalent feelings (which originate in craving beliefs) with respect to the use of substance by lowering the level of automatic responses to stressful experiences and also by raising awareness and acceptance of life events [16]. In this procedure, a person deals with craving beliefs as though they are only thinking experiences while trying to avoid confounding them with incorrect past experiences and strategies. Moreover, the findings of the present research suggested that mindfulness training coupled with exercise with and without daily self-monitoring reports (performed on the first and second groups), compared to the other groups (including mindfulness therapy and control groups) is effective in reducing craving beliefs, which shows the efficacy of exercise. It is a remarkable point that doing exercises brings about both emotional and cognitive impacts on a person and lowers the possibility of relapsing into addiction. Regarding the emotional influence of exercise, studies propose that this activity can compensate for many neurochemical mediators which have been reduced due to substance abuse. For example, the rise of beta-endorphins during exercise leads to vitality and changes in one's temper [11]. Generally, stress is known as an important mechanism that can cause drug dependence and increase craving and relapse probability [18].

Hence, it is expected that motorsports activities will be helpful in relapse prevention by reducing the conditions leading to psychological disorders [19] and by lowering resistance to treatment [20]. On the other hand, while research has shown that mindfulness-based therapy reduces anxiety and depression in substance abusers [20], it can be posited that perform an exercise, by decreasing negative emotional symptoms and improving the temper, not only diminishes one's tendency to drug abuse but also it can add to the efficacy of training mindfulness therapeutic skills so as to mitigate psychological disorders [19] and decrease drug abuse.

In line with the cognitive dimension of exercise efficacy, the hypothesis that has been proposed recently emphasizes on the role of executive function impairment of the frontal cortex in substance abuse. For this reason, in the information processing approach, cognitive factors, as mediating variables, play an important role in the relapse phenomenon in addicts [21]. Besides, studies have indicated that exercise can strengthen and refine brain functions (concentration, reasoning, learning, and forgetting) [12]. In addition, longitudinal research has found that chess helps improve metacognitive abilities and thinking skills [22], and also enhances brain functioning [11]. Therefore, exercise is effective in strengthening nerve cells and synapses involved in memory [23] and reduces cognitive component of smoking temptation [24]. Considering that mindfulness requires concentration and maintaining attention on inner experiences, it is reasonable that taking part in sport activities results in raised concentration, evaluation, correcting one's mistakes, and ability to fix one's attention. As a result, it increases the effectiveness of mindfulness. For the first time, an interventional study showed that regular aerobic exercise can increase mindfulness in men [26].

The significant effect of mindfulness training paired with exercise and daily self-monitoring reports on the reduction of craving beliefs, compared to the first group (mindfulness and exercise), points to the effectiveness of performing exercises. Hence, exercise, daily self-

monitoring reports, and directing one's focus to thoughts, emotions, and inner experiences at home play a key role in the continuous improvement of mindfulness; furthermore, in high-risk situations, they have the potential to increase treatment longevity [27]. At each stage of self-monitoring reports, individual observes his/her performance in the front of temptations and directs his/her endeavors with regard to his/her progress or regress. This is similar to the scenario of the brain recovery through neuro feedback in which a person learns to alter voluntarily his/her brainwaves, using the feedback received from the device, and thus to see his progress.

In short, given the results, it is recommended that appropriate behavioral interventions be coupled with cognitive methods so as to attain the desired objectives. The limitations of this study included the lack of follow-up periods to ascertain the comparison of the type of supplementary interventions and sustaining the effectiveness of the mindfulness training courses. Another constraint was the lack of attention to factors such as familial and socio-economic status of substance abusers; factors which are suggested to be taken into account in future studies.

### **Conclusion**

In conclusion, underscoring a conscious attention to the present moment, being exposed to unpleasant feelings and thoughts, and accepting negative inner experiences lead to a reduction in activating craving beliefs of substance abuse. In this way, we can see cognitive changes and decreased related symptoms. Moreover, intellectual/motor sports activities are an occasion for keeping a person concentrated in the present and in this manner, they may be regarded as mindfulness techniques in themselves and therefore, they can enhance the efficacy of mindfulness. Also, as a favorable alternative, sport activities helps stop substance abuse caused by evading negative inner experiences. Therefore, two major cyclical channels of negative cognitive and behavioral strategies, associated with inner

experiences, are blocked by mindfulness coupled with sport activities, leading to a decrease in craving beliefs. Thus, combining sports exercises with mindfulness technique of substance abuse treatment increases the potential effectiveness of change after mindfulness.

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### Contribution

Study design: HB, FShZ

Data collection and analysis: FShZ, HB

Manuscript preparation: FShZ

### Conflict of Interest

"The authors declared that they have no competing interests".

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