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Comparison of the Effectiveness of Dialectical Behavior Therapy and Compassion-Focused Therapy on Blood Cortisol and Serotonin Levels in Drug Abusers

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Abstract

Background and Aims: This study aimed to compare the efficacy of dialectical behavioral therapy (DBT) and compassion-focused therapy (CFT) on the blood cortisol and serotonin levels in drug abusers.

Materials: This quasi-experimental study was conducted based on a pretest-posttest control group design. The statistical population consisted of all male drug abusers who were referred to the Adult Drug Abuse Clinic of Torbat-e-Heydariyeh, Iran, during 2018. In total, 60 cases were selected through simple random sampling and subsequently divided into two experimental (DBT, CFT) and one control group. Afterward, the experimental group participated weekly in 90-min training sessions for 10 weeks. On the other hand, the control group was on the waiting list and received no training. Afterward, the data were collected using a demographic characteristic form, as well as in vitro serum test of cortisol and serotonin levels before and after the intervention. Eventually, the data were analyzed in SPPS software (version 24) using Multivariate analysis of covariance (MANCOVA).

Results: The results of MANCOVA revealed that self-control and blood cortisol had a significant effect on post-test in both DBT and CFT groups ($P<0.005$). However, given the mean differences, CFT showed more significant effects on the blood cortisol and serotonin levels, compared to DBT.

Conclusion: According to the findings, both DBT and CFT were effective in the reduction of cortisol and elevation of blood serotonin in drug abusers; however, CFT was more effective than DBT.

Keywords: Blood cortisol level, Blood serotonin level, Compassion focused therapy, Dialectical behavioral therapy, Drug abuse

1. Introduction

Drug abuse is defined as the frequent and prolonged use of a drug in a way that its deprivation leads to an uncontrollable desire to reuse as well as physical and psychological problems. Drug addiction is a global problem, and statistics from international notable organizations, such as the World Health Organization, the World Narcotics Control Committee, and UNESCO, indicate an increase in the use of drugs worldwide (1). Every year, a large number of people with drug abuse disorders lose their lives as a result of the direct and indirect consequences (2). Additionally, drug abuse is a set of cognitive, behavioral, and psychological symptoms of repeated use that leads to tolerance, avoidance, and coercive acts (3).

Studies have shown that physical and psychological stressors lead to the stimulation of the hypothalamus and corticotropin-releasing factor which in turn increases the cortisol secretion from the adrenal gland (4). Cortisol is a catabolic hormone and the major form of glucocorticoid in humans. This hormone is secreted from the cortex of the adrenal gland in response to physiological and psychological stress (5). Moreover, it simply enters the brain cells and its changes can cause behavioral alterations, interference with cognitive function, gastrointestinal disorders, and adverse immune function. Therefore, physical and cognitive anxiety plays an important role in the release of cortisol in people with drug abuse which has negative consequences (6, 7). Mental and personality problems can be the cause of substance abuse, and most studies have reported the concurrency of drug abuse and mental disorders. Consequently, the ignorance of mental disorders before and after quitting is one of the factors that leads to treatment failure and drug reuse (8).

Behavioral and psychological therapies in individuals are among the strategies used in the control of body stress hormones, such as cortisol, and helped patients to continue treatment for a longer time (9). Long-term drug abuse is one of the causes of disorder in the serotonergic system which can cause comorbidity of drug use (10). Serotonin is a neurotransmitter that plays an important role in a person's

mood, sexual behavior, sleep, pain, and aggressive power. Furthermore, the disruption of the serotonin secretion process is one of the hormonal abnormalities in drug abuse due to psychological problems (11). Other than medication therapy, numerous cognitive interventions have been devised over the years to address psychological problems, including anxiety. Psychological interventions are ways of communicating with positive, negative, and neutral experiences. These techniques help people to identify involuntary patterns of mind and turn them into conscious and voluntary patterns so that negative emotions and thoughts be perceived as simple and transient matters in the mind (12, 13).

Dialectical behavioral therapy (DBT) is a type of cognitive-behavioral therapy developed by Marshall Linnen for the treatment of people with chronic suicidal behavior and comprises four sections, namely 1) Individual Learning Skills, 2) Group Learning Skills, 3) Telephone Counseling, and 4) Therapist Counseling Group (14). Lenin's fundamental assumption in the formulation of DBT is that individuals with no cognitive-emotional adjustment lack the skills to solve their problem, and this in turn causes severe problems for the patients (15).

Standard DBT protocols include essential skills associated with the treatment of drug abuse disorders that are used for patients with this disorder. These skills help the person cope with the temptation of using drugs and reduce the risk of return utilizing such techniques as mindfulness, distress tolerance, emotion regulation, and interpersonal skills. The DBT enhances positive body image and increases self-efficacy in individuals, especially those with substance-use disorders (16).

The concepts of self-compassion, self-judgment, self-care, and self-understanding, as well as reduction of self-criticism and self-judgment, are the recent issues that have attracted the interest of many researchers. Compassion is a way to reduce the anxiety associated with mental disorders (17). Therefore, compassion-focused therapy (CFT) can play a protective role against depression, anxiety, and repressive thinking. This therapy can develop self-compassion, reduce self-criticism, anxiety, and stress, suppress negative thoughts and emotions, regulate emotions, and lead to self-control. Self-compassion was first defined by Nephi as a three-component model of self-compassion versus self-judgment, human communion versus isolation, and self-awareness versus incremental simulation. The combination of these three related components makes the feature that is called compassion in an individual. Therefore, self-judgment and self-criticism of one's shortcomings and inadequacies will be replaced by self-compassion and self-understanding. Furthermore, the person admits that all humans are defective, make mistakes, and have unhealthy behaviors and that these are a common characteristic of human beings (18). Awareness leads to the attainment of insight into the current experiences and painful aspects that should not be ignored.

Compassionate imaging increases heart rate variability and reduces cortisol levels in people with low levels of self-criticism (19). The CFT is focused on a model of emotion regulation, brain states, and personal experiences. This is especially important in addressing self-criticism and shame in people with a history of violent and unhappy lives (20). Therefore, given the high importance of the negative consequences of drug abuse disorder in the community, and the effective role of psychological therapies in reducing drug abuse disorder, this study aimed to investigate the efficacy of DBT and CFT on changes in blood cortisol and serotonin levels among drug abusers.

Methods

This quasi-experimental study was of pretest-posttest control group design. The statistical population consisted of males with drug abuse disorder who referred to Bozorgmehr addiction treatment center in Torbat-e-Heydariyeh, Iran, after detoxification. The study protocol was approved by the Research Council and Ethics Committee of Neyshabur Branch, Islamic Azad University, Iran (IR.IAU.NEYSHABUR.REC.1397.016) and registered at the Clinical Trial Center (IRCT20181022041421N1). Afterward, simple random sampling was performed, and 60 persons were selected based on a statistical formula and similar studies from those who had been referred to the addiction treatment center of Torbat-e-Heydariyeh , Iran (21). They were selected and divided into two experimental groups (DBT and CFT) and one control group. Inclusion criteria were: 1) existence of no psychiatric illnesses and mental disorders, except for drug abuse, 2) provision of written consent, 3) willingness to attend therapy sessions, 4) male gender, 5) negative chromatography test, 6) minimum of high school education and a maximum of the bachelor degree, 7) age range of 20-40 years (22), 8) not attending other psychotherapy sessions and the anonymous addicts association, 9) drug addiction history of at least 12 months (23), and 10) consumption of drugs that affect cortisol and serotonin variables, such as cortisone, anxiolytic, and antidepressants. On the other hand, those who were absent in more than two sessions, lacked the interest to cooperate with other individuals and failed to perform specified tasks in the educational process were excluded from the study.

A demographic characteristics form and an *in vitro* measurement of blood cortisol and serotonin levels were used to collect data. After the selection of the sample size and explanation of the study objectives, informed consent was obtained from the participants, and they were divided into one control and two experimental groups. Afterward, five ml of venous blood samples were collected from the participants in a sterile dry tube at 8 a.m. and sent to a laboratory to measure serum cortisol and serotonin levels. Blood cortisol and serotonin levels were assessed by ELISA using an IBL kit made in Germany. In the next stage, the experimental groups were assigned to receive either DBT or CFT, and they were requested to participate weekly in 90-min training courses for 10 weeks (Tables 1 and 2). It should be mentioned that the participants were provided with assignments to complete at home. On the other hand, the control group received methadone maintenance therapy; however, they were assured that they would receive the intervention after the completion of the study. Immediately after the end of the training sessions, a post-test was conducted to measure the serum cortisol and serotonin levels.

Urine chromatography was performed according to

methadone maintenance therapy (MMT) protocol during the training sessions. The participants were reassured that their information would be kept confidential and that no harm would be caused to them. Data were analyzed in SPSS software (version 24) using descriptive and inferential statistics through multivariate analysis of covariance (MANCOVA).

Table 1. Content of dialectical behavior therapy sessions

Session	Content
1st session	Introducing the members to each other; Explaining the purpose of training sessions, study duration, and the number of sessions; Administering the pre-test (filling in the demographic characteristics form and sample collection for the measurement of blood cortisol and serotonin levels.
2nd session	Teaching the skills to overcome the obstacles of healthy emotions and preserve hope so that one can understand how emotions affect thoughts and behaviors.
3rd session	Discussing the reduction of physical vulnerability to disruptive emotions and how people's thoughts and behaviors can affect their emotions.
4th Session	Discussing the reduction of cognitive vulnerability and understanding how thoughts affect feelings.
5th session	Teaching the skills to increase positive and pleasant emotions (happiness) and overcome negative emotions (anger, fear, and sadness).
6th Session	Teaching the skills to have conscious awareness of emotions without judgment (learning to control emotions consciously without judging them, as well as reducing the chances of exacerbation, problems, and emotional distress).
7th Session	Teaching the skills to cope with emotions (dealing with emotions rather than evading them, which is one of the main goals of the dialectical behavior therapy approach).
8th Session	Teaching the skills to act against the overwhelming emotions and why we need to understand the feelings.
9th Session	Teaching the problem-solving skills (emotion regulation before the activation of turbulent feelings)
10th session	Receiving feedback from team members based on the principles taught; Reviewing and summarizing the contents taught previously; Administering the post-test (evaluation of blood serotonin and cortisol levels).

Table 2. Content of compassionate focused therapy sessions based on Gilbert's treatment plan

Session	Content
1st session	Introducing the members to each other; Teaching the general concept of self-compassion and empathy; Administering the pre-test (filling in the demographic characteristics form and sample collection for the measurement of blood cortisol and serotonin levels.
2nd session	Explaining session objectives and characteristics of a group (group definition); Teaching rhythmic breathing skills.
3rd session	Teaching empathy; Examining the way members deal with self-criticism or compassion (defining self-criticism and its consequences; Defining compassion; Teaching concepts, such as being understanding and empathetic. It should be noted that rejection by the group is one of the biggest fears of individuals in an interview.
4th Session	Teaching the concept of self-compassion, its features and skills, and how it affects one's mental states; Introducing three emotional regulation systems and the way they interact; Teaching skills to be more concerned about people's issues and care more about their health.
5th session	Teaching forgiveness, awareness, its logic, and how it is practiced, (focus on breathing and tracking emotions and thoughts and watching them without any reaction).
6th Session	Introducing mental imagery and its logic; Teaching mental imagery techniques; Implementing mental imagery in the group (color, location, and compassion).
7th Session	Teaching self-compassion concepts (Wisdom, ability, warmth, and responsibility for generating compassion); Teaching self-compassion and developing valuable and transcendent emotions in the person to deal with the environment effectively.
8th Session	Teaching self-centered compassion and identifying its different aspects (attention, thinking, feeling, behavior, and self-awareness).
9th Session	Recalling compassion skills; Explaining the role of compassion in guiding thoughts and responses in the face of criticism
10th session	Receiving feedback from team members based on the principles taught; Reviewing and summarizing the contents taught previously; Administering the post-test (evaluation of blood serotonin and cortisol levels).

Results

According to the obtained results, the mean age of the participants was 33 years. Moreover, the majority of them were single (53%) and had a diploma (46%). Additionally, the most consumed drug among the participants was methamphetamine (40%). Table 3 summarizes the mean±SD of two variables at the pre-and post-test in one control, as well as DBT and CFT groups.

In this study, the results were analyzed using MANCOVA, and the Kolmogorov-Smirnov test showed normal distribution of communities (P>0.05). Moreover, the Levin test was used to test the equality of variances by default. The results showed a significant difference in the cortisol (F=0.24, sig=101, F=2.188) and serotonin levels (F=0.482, sig. 0.621) at the post-test. In addition, the equality of variances was confirmed for all variables at the post-test. Additionally, Box's test was employed to test the equality of covariances. The results of the Box's test were obtained for the heterogeneity of variance-covariance matrices (sig=0.103, F=1.761, M box=11.346), which confirmed the equality of default covariance in all the analyzes. The interaction between dependent and covariate variables was investigated to examine the homogeneity of the regression slope assumption. The results of this analysis revealed no significant interaction in cortisol (sig=0.155, F=1.633) and serotonin levels (sig=0.224, F=1.423), which was indicative of slope homogeneity assumption (P>0.05). The confirmation of all the assumptions indicated that the MANCOVA technique could be used for the investigation of the research hypotheses.

Table 4 displays significant values obtained from the Wilks' lambda test (P<0.05). In the other words, there was a significant difference between the experimental and the control groups regarding at least one of two variables of blood cortisol and serotonin levels. The obtained rate of difference (31%) indicated that 31% of the individual differences in the variables were due to differences between the groups. The effectiveness of the two treatments were also compared using MANCOVA (Table 5).

According to Table 5, after the elimination of the effect of pre-test scores, a significant difference was observed between DBT and CFT groups regarding the mean of post-test scores of blood cortisol and serotonin levels (P<0.05). Moreover, the effective rates of this treatment were determined at 29% and 43% on the reduction of cortisol and serotonin levels, respectively. The statistical power of 0.99 indicated that the sample size was sufficient for the attainment of this conclusion. Bonferroni test was performed to determine which groups were different at the post-test (Table 6).

According to the results of the Bonferroni test presented in Table 6, there was no significant difference between DBT and CFT in terms of blood cortisol levels (P>0.05). However, a significant difference was found between DBT and CFT regarding cortisol and serotonin levels (P<0.05). In addition, there was a significant difference between DBT and the control group in terms of blood cortisol and serotonin levels. There was also a significant difference between CFT and the control group regarding the dependent variables (P<0.05). Therefore, both treatments decreased cortisol levels and increased blood serotonin levels in drug abusers (P<0.05).

Table 3. Descriptive statistics of the study based on variables and type of test

		DBT[1]		CFT[2]		Control	
Dependent variables		**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Cortisol levels	Pre-test	17.33	1.447	17.80	1.014	17.40	1.270
	Post-test	1.579	1.579	15.60	0.948	17.33	0.994
Serotonin levels	Pre-test	158.80	13.53	181.00	11.49	164.00	14.808
	Post-test	183.733	15.781	194.800	11.699	165.400	15.610

Table 4. Multivariate analysis of covariance for the comparison of experimental groups in terms of dependent variables

Effect	**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**	**Partial Eta Squared**	**Observed Power**
Pillai's Trace	0.534	7.655	4.000	84.000	0.000	0.26	0.999
Wilks' Lambda	0.475	9.232	4.000	82.000	0.000	0.31	0.999
Hotelling's Trace	1.083	10.831	4.000	80.000	0.000	0.35	0.999
Roy's Largest Root	1.064	22.342	2.000	42.000	0.000	0.51	0.999

Table 5. Multivariate analysis of covariance for the comparison of three groups in terms of research variables

Dependent Variable	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power
Cortisol Levels	26.978	2	13.489	8.806	0.001	0.29	0.999
Serotonin Levels	7247.711	2	3637.356	15.786	0.000	0.43	0.999

Table 6. Bonferroni test for the comparison of research variables in three groups

Groups	Groups	Mean Difference	Sig.	Dependent Variable
Cortisol levels	DBT*	CFT**	0.20	1.000
	DBT	Control	1.53	0.004
	CFT	Control	1.73	0.001
Serotonin levels	DBT	CFT	11.000	0.159
	DBT	Control	19.733	0.003
	CFT	Control	30.733	0.000

*Dialectical behavior therapy
**Compassion focused therapy

Furthermore, given the obtained mean difference, it was shown that CFT decreased cortisol levels and increased blood self-control more effectively, compared to DBT.

Discussion

The results obtained from MANCOVA demonstrated that both treatments had a significant effect on decreasing cortisol levels and increasing blood serotonin. However, according to the mean difference, the efficacy of the CFT was greater than that of the DBT. It is worth mentioning that the results of the DBT effects on cortisol levels were in line with the findings obtained from studies conducted by Crashbaum et al. (24), Hsiao et al. (25), Samadi et al. (26), and Naghi Nasab et al. (27).

Regarding the efficacy of DBT on serotonin level, the results of the present study were consistent with the findings of studies conducted by Romanelli et al. (28) and Soetrisno et al. (29). Furthermore, the results of the effect of CFT on cortisol level were in line with the findings of the studies performed by Brooks et al. (17), Neff and Germer (30), Gilbert (31), Goss and Allan (32), and Lowens (33). Similarly, the results of the effects of CFT on serotonin levels were consistent with the findings of the study conducted by Vakili et al. (34).

Based on the obtained results, DBT can be effective in reducing negative thoughts, emotions, and stress levels, as well as increasing self-efficacy and performance in people with drug abuse. Some studies have proven the effectiveness of these practices in the enhancement of performance and related factors, such as attention and concentration, control, and anxiety (35). Given the effects of negative emotions on drug abusers, high levels of these emotions appear to lead to the impaired functioning. Additionally, drug addicts with impulse control problems are increasingly impulsive, irresponsible, and cognitively cluttered. In addition, due to the lack of rational thinking, they cannot pay attention to the consequences of their actions. Therefore, one of the reasons for the success of DBT was its contribution to the reduction of negative emotions and hormonal problems in drug addicts, which in turn resulted in the reduction of the abnormal emotions experienced by them (36).

It should be noted that drug abusers avoid accepting their addiction using the defense mechanism of denial. Since the goal of DBT is the creation of a balance between change and acceptance, the emphasis in this therapy is on the patients' recurrence and prevention of negative emotions regarding the condition that makes them dysfunctioning, besides the reference change. Basic acceptance skills allow these people to change harmful behaviors, embrace their own strengths and emotions, discover their values, and cope with stressful situations by getting help in order to make their lives more satisfying through a commitment to their promises.

Self-compassion plays a role in the prediction of motivation for treatment and readiness to change drug dependency. In addition, the risk of drug use is positively associated with self-compassion, shared human experience, and mindfulness; however, it is negatively correlated with isolation. These results support the protective role of self-compassion in drug abuse. This indicates that self-compassion will increase self-control among drug abusers. Hormonal changes and lack of self-control are inappropriate stimulants to the development of cognitive structure in addicts which in turn leads to the creation of enticing thoughts about the effects of drugs. Usually, these tempting thoughts cause the person to think of their existence as a failure.

One of the key elements of cognitive self-compassion therapy is the reinforcement of a sense of acceptance, and education in this regard helps addicts not to blame themselves for having drug favoring thoughts with unrealistic judgments and evaluations (37).

Therefore, it can be argued that CFT promotes kindness and understanding; moreover, it avoids the appearance of

self-criticism and self-judgment in addicts. In this study, the participants learned to understand their problems rather than criticize and judge them unnecessarily. Moreover, self-compassion training for people with drug abuse disorder can mitigate the distress caused by the negative experiences and emotions that threaten them. Furthermore, this practice makes people more aware of the nature of their distress and problems and instructs them on how to counteract these feelings and improve their self-control which in turn leads to the better regulation of their hormones.

The reason for the higher impact of the CFT, compared to DBT, is that people with high self-compassion try to be aware of and confess to all negative aspects of their lives, including addictive behaviors, behavior assessment, and critical evaluation. Awareness-raising regarding the conditions and symptoms that trigger drug cravings is one of the important aspects of CFT.

Cognitive self-compassion therapy has been able to change emotions and feelings regarding drug abuse and familiarize people with the physical and psychological complications and risks for themselves and their families by teaching concepts such as self-care and self-esteem, as well as the development of transcendent emotions toward drug abusers. Furthermore, practices on how to cope with tempting situations and understand the abilities to control these situations also reduce drug dependence. Therefore, addicts will care more about the development of human values and high emotions. This treatment helped people to change the way they were thinking about themselves and their abilities and avoid negative thoughts. Consequently, they spent their lives more on positive things, such as working and leisure activities; therefore, they gave up focusing on drugs and other negative thoughts.

Regarding the limitations of the present study, one can name the lack of control on variables, such as drug use, lack of follow-up, and limited community of drug abusers. The strengths of this study lay in the high accuracy of the laboratory apparatus for measuring blood cortisol and serotonin levels, the regularity of the training sessions held, and the willingness of the experimental groups to attend the meetings and follow up the study results. According to the results of this study, the DBT and CFT decreased cortisol levels and increased blood serotonin in drug abusers. Therefore, it is recommended to apply these treatments in drug addiction clinics and counseling centers.

Conclusion

Detoxification comprises only 3% of the total treatment process of drug abuse disorder, and the remaining 97% of the process involves psychological dependency on drug use (38). Accordingly, psychological therapies can be very beneficial to the treatment of drug abuse disorder. The DBT and CFT were two therapies used in this study, and according to the results, they led to a decrease in the cortisol level and an increase in the blood serotonin level among people with drug abuse disorder. Therefore, considering the low cost and effectiveness of these treatments in the improvement of psychological symptoms, it is recommended to use them after detoxification.

Acknowledgments

The present study was extracted from an original research project, and the study protocol was approved by the Ethical Committee of Neyshabur Branch, Islamic Azad University, Iran (IR.IAU.NEYSHABUR.REC.1397.016) and registered in the Clinical Trial Center (IRCT20181022041421N1). Hereby, the authors are thankful to the study participants for their hard work and the respected authorities of the drug addiction clinic in Torbat-e-Heydariyeh, Iran, for their cooperation.

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