

The Efficacy of Contingency Management on Cocaine Craving, using Prize-based Reinforcement of Abstinence in Cocaine Users

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Abstract

Introduction: Contingency management (CM) is one of the most common therapies in the domain of drug addiction. This study has been carried out with the purpose of evaluating the efficacy of contingency management intervention.

Method: In an experimental design, between December 15, 2014 and November 20, 2015, fifty men (between 18 and 31 with an average age of 24.6) with a history of cocaine use, were selected voluntarily and were randomly assigned into two groups of CM and control group. The CM group were awarded coupons for negative urine tests, over a period of twelve weeks. The urine tests were taken from the participants twice per week, with cutoff concentrations for positive set at 300 ng/ml and self-reporting index of cocaine craving (response rate = 96%) were evaluated in two phase, through pretest and posttest measures. The data were analyzed by parametric covariance test. Additionally, the qualitative data, resulted from demographic measures, were coded and were analyzed with the help of an analysis instrument of qualitative data i.e. ATLAS.ti-5.2.

Results: The primary outcome was the number of negative urine tests and the secondary outcome included the cocaine usage craving index over twelve weeks. The mean of (95% of confidence) number of negative cocaine urine tests was 15.4 (13.1–17.8) in the CM group and 19.7 (17.7–21.6) in the control group ($P = 0.049$). Also, results showed that CM has a significant effect on reducing craving ($p < 0.01$).

Conclusion: The findings of this study, while having practical aspects in this domain, can be valuable in planning remedial procedures.

Keywords: Behavioral therapy, Token economy, Craving, Psychotherapy, Contingency Management (CM)

1. Introduction

One of the modern therapies with approved and tested clinical efficacy in the realm of drug abuse, is contingency management (CM) therapy. The theoretical foundation of this remedy has a behaviorist basis, and is dependent upon conditioning the subject. CM, shapes behavior by way of using secondary positive incentive rewards such as coupons, goods and services. In order to obtain useful remedial response, most of the reinforcement programs change during the management period (1). CM have highly supported clinical experiments (2, 3) and successfully applied to a wide range of behavior such as adherence to therapy, losing weight and quitting smoking (4-7). The researchers also used this approach to improve behavioral objectives in many various communities (8-10). One of

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the most applicable domains of CM remedy is the domain of drug abuse, where it has been explored greatly, and its advantages regarding a wide range of drugs (stimulants, alcohol, marijuana, tobacco) in various circumstances (bedridden, outpatient inspection) have been commended (2, 9-12). One particular positive point of CM is its capability of focusing on the behavior of a specific target (8, 13-15). In contrast, for the weak points of CM we can refer to ignorance of target behavior in conditions when the reinforcement is not continuous or ongoing (16, 17). According to research literature, the remedial period of CM varies from five days (18) to two or three years (17). Furthermore the productiveness of contingency management approach for avoidance of a wide range of drugs including benzodiazepines (19), nicotine (20), Opioids (21, 22), marijuana (23, 24) and methamphetamines (25, 26) has been shown. CM has demonstrated many times its usefulness in usage reduction of cocaine: therefore, we intend in this study, to explore the efficacy of respective remedy on reduction of habitual usage of cocaine in form of a controlled clinical experiment.

2. Material and Methods

2.1. Study setting

This experimental study was carried out on male cocaine users in Tehran who had been visiting Bijan Addiction Clinic with the purpose of usage avoidance from September 15 to November 15, 2014. From this population, fifty four individuals were selected by voluntary sampling methods and based on knowledge of them through previous studies. For individual counseling sessions, counselors completed a semi-structured psychosocial assessment and treatment plan for each participant.

2.2. Eligibility criteria

Eligibility criteria for initial enrollment included: 1. age range of 18 to 31 years, and 2. Physical dependency to cocaine (by self-reporting). Eligibility for randomizing the subjects into groups was based on subsequent cocaine use. In conducting this study, one doctor, one psychiatrist, one clinical psychologist and one nurse cooperated. The inclusion and exclusion criteria were highly controlled. The inclusion criteria was comprised of: 1) having the age range of 18 to 31 years, 2) having three months history of cocaine avoidance and 3) having at least the educational level of diploma. The exclusion criteria included: 1) being psychotic or bipolar or having major depressive disorders, 2) current physical dependence on alcohol or sedatives, 3) having an unstable serious medical illness and 4) having an IQ below 80.

2.3. Data collection

The data of this research were collected during the time period from September 15, 2014 to November 20, 2015 using clinical interviews and self-reported questionnaires. Participants were screened in two on-site visits which included medical, psychiatric, and drug use history, a physical examination, urine and blood screens and an array of assessment instruments. The values of incentive rewards in this study were three thousand, fifteen thousand and thirty thousand Tomans (approximately 1, 5 and 10 dollars, respectively). Payments in this program were at most, 550 dollars' worth of coupons (to each group) and were in accordance to other treatment programs (27, 28). The entire cost of incentive rewards during the period of three months was 1200 dollars. The urine test band was used to investigate cocaine metabolite over four weeks, in the form of two weekly evaluations and subsequently used randomly once every fifteen days. The validity of the samples was controlled by studying urine temperature, creatinine and PH, and the threshold of 300 ng/ml was considered for urine analysis. For negative urine samples (urine without cocaine), a coupon was specified. The rewards for negative urine tests of metabolite cocaine in the first sample were considered as 1 dollar, for the second sample, the reward was considered 3 dollars, and for the third negative test it was considered as 5 dollars. In the next stages, after the urine negative test report was given to the participants, 1.25 dollars was added to the reward value. Coupons began from one dollar for each urine sample without stimulant and increased up to twenty dollars. Examining subjects' urine was carried out in two days per week from 10 a.m. to 6 p.m. After examining the tests, participants were motivated to continue to take part in the study by email. All of the participants signed a contract in terms of expectations of the remedial program (3). Also, urine samples were taken from participants of the control group during the treatment in order to ensure participants' commitment to usage avoidance, however, no coupons were issued to them. After completing twelve treatment sessions, all participants of the study were evaluated for the second time, but this time, they were evaluated in the form of a posttest through a 'Craving for Cocaine Usage' questionnaire. During the study, urine specimens were collected under observation of a laboratory technician, every Monday and Friday. Urine specimens were analyzed by enzyme-multiplied immunoassay technique (EMIT) system that provided qualitative results for benzoylecgonine equivalents (cocaine) with cutoff concentrations for positive set at 300 ng/ml. Furthermore, self-reporting index of cocaine craving was evaluated in two phases through pretest and posttest measures.

2.4. Categories of prizes

Gift cards (coupons) were used for purchasing goods from supermarkets, and cash was not used in this study. Coupons were exchanged with the aim of exchanging goods and services and improving social and sound behavior (1). Examples of rewards available in each of the three categories were as follows: small-fast food coupon, bus pass, toiletries, or food and drink items; large-portable stereo, watch, clothing item, kitchen implement, or retail gift certificate; jumbo-small television, small stereo, or any five large prizes.

2.5. Randomization

Initially fifty four participants registered for the study. Sometime after the beginning of the study (between the third and the ninth week), four persons were removed from the study for reasons such as absence from treatment sessions or report of positive urine test. Consequently, fifty participants were selected and were assigned into experimental and control groups (25 persons in each group) using Microsoft excel.

2.6. Ethical Principles

The purpose of the study was explained to each participant and consequently, written informed consent was obtained from them. There was also caution that the research methods did not contradict with the religious and cultural principles of the participants, and the participants were respected in all stages of design, implementation and reporting in terms of human dignity, respect and protection of their physical and mental integrity, so that conducting the research would not delay in the process of medical care for the participants.

2.7. Statistical analysis and sample size

In this study, with regard to one-way direction of test and assumption of $Z=1.645$, $d=0.2$, $\alpha=0.05$ and also power of test $1-\beta=0.84$, it was estimated that the size of sample would be equal to 50. In the present study, descriptive data were given as mean and standard deviation. Moreover the qualitative data, resulted from demographic evaluations, were coded and analyzed by analysis of qualitative data instruments such as ATLAS.ti-5.2. In section referential analyses regarding existence of independent framework in terms of pretest and posttest, and also regarding the interval between usage avidity measures from parametric tests, covariance analysis and independent t-tests were used. Since the condition of equality of variance was confirmed in Leven test, the use of this test was considered suitable and proper (29). Our assumption was that CM is effective in avid usage index of cocaine. For the analysis of data, IBM SPSS Statistics Version 20 (IBM Corp., Armonk, NY, USA) was used.

2.8. Instruments

In this study, structured clinical interview, demographic researcher-made questionnaire, Cocaine Craving Questionnaire and Urine sample test were used.

2.8.1. Clinical structured interview for disorders (SCID)

SCID is a clinical interview, used for distinguishing axis-one disorders based on DSM-IV. The final coefficient for measures of SCID was reported as 0.60 (30). The identification agreement of this instrument in Persian language was useful for most of the special and general determinations with reliability of higher than 0.60. Copia coefficient for all of the current determinations and determination of lifetime were 0.52 and 0.55 respectively (31).

2.8.2. Demographic questionnaire

The Demographic Questionnaire was conceived by the researcher, with the aim of applying and collecting individual information such as age, education, marital status, employment and period of drug use.

2.8.3. Cocaine Craving Questionnaire

This instrument was designed by Tiffany et al. (32). Its abridged version includes ten statements of which its psychometric features were investigated by Sussner et al (33) on a sample including 247 cocaine users. The correlation of this index with Beck's depression index 0.39, anxiety index 0.35 and with recent drug use 0.26 was reported. Also the correlation of an abridged form with the original form of the questionnaire was estimated 0.85 and the internal reliability of this measurement, according to Cronbach's Alpha, was an estimated 0.90.

2.8.4. Urine sample test

In the form of Cocaine kits representing addiction, urine samples were taken randomly in a period of four weeks in the form of two times per week and subsequently once every fifteen days.

3. Results

3.1. Demographic features of the participants

Table 1 shows the demographic state of the participants of the study. Regarding education, most of the participants had an educational level higher than diploma (CM: 64%, control: 72%). Concerning age, most of the participants

were younger than 25 years old (CM: 68%, control: 60%). Regarding financial status, most of the participants in both groups had an income of less than 200 dollars per month (CM: 60 %, control: 68 %). The results of a Leven test to study the equality of the respective variances represented a lack of significance of this index. Therefore, using statistical covariance analysis to compare two groups was possible. On the other hand, the results of independent t-test in CM ($t_{(48)}=2.03$, $p=0.09$) and control group ($t_{(48)}=3.11$, $p=0.69$) showed a lack of significance of the scores of the control and experimental groups in pretest. The mean and standard deviation of scores of craving showed there was no significant difference between the levels of craving in the control group in pretest (Mean: 17.94, SD: 1.95) and posttest (Mean: 17.24, SD: 2.78), but in the experimental group there was a significant difference between the levels of craving in pretest (Mean: 18.23, SD: 2.12) and posttest (Mean: 14.79, SD: 2.29). Also, the mean of (95% of confidence) number of negative cocaine urine tests was 15.4 (13.1–17.8) in the CM group and 19.7 (17.7–21.6) in the control group ($p = 0.049$).

Table1. Demographic status of the participants of the study

Indices		CM		Control	
		n	%	n	%
Education level	Lower than high school diploma	9	36	7	28
	Higher than high school diploma	16	64	18	72
Age (year)	18-25	17	68	15	60
	>25	8	32	10	40
Employment status	Employed	11	44	10	40
	Unemployed	14	56	15	60
Monthly income (U.S. dollar)	<200	15	60	17	68
	>200	10	40	8	32

3.2. Covariance analysis test

Table 2 shows the results of the covariance analysis test. Based on this, between the average of posttests of two groups, a significant difference was observed ($p<0.01$). With respect to the above results, we can say that contingency management had been effective in cocaine avid usage index.

Table 2. The results of covariance analysis test to compare posttest scores of two groups of the study

Variables	SS	Df	MS	F	p-value	Eta
Pretest	6643.15	1	6643.15	7.29	0.01	0.64
Group	911.27	1	911.27	-	-	-
Error	4941.12	49	100.83	-	-	-

4. Discussion

This study was carried out with the purpose of investigating the CM method in cocaine avid usage index in the form of usage avoidance. The investigation of research literature reveals the efficacy of CM in a wide variety of drug abuse (2, 9-12). The results of the current study showed that respective remedy had been significantly effective in reducing the extent of avid usage in people dependent on cocaine in terms of usage avoidance. The researcher observed some of the studies, undertaken regarding the efficacy of CM in usage reduction or increase of avoidance period, through exploring PubMed information center. Consistent with the findings of the present study, the results of the studies by Hijin et al. (1) showed CM can result in increasing the periods of avoidance of use in cocaine users, and the duration of the avoidance continued to at least up to six months. The main difference between the study by Hijin and the present study is in the application of CM as a complement for a society-oriented strengthening approach that could improve therapeutic effects. The results of the present study showed that the treatment could increase the frequency of negative urine tests compared to the control group. Increased cocaine craving during the treatment process was significant, compared to the control group in the present study. Consistent with the results of the present study, Preston et al. (34) reported that conditioned management treatment reduces the rate of drug use and also the craving for heroin use in outpatients who use methadone. The results of the study by Sindelar et al. (35) showed, adding conditioned management treatment to common treatments in methadone clinics will have a more productive effect on therapeutic consequences in these patients. As research literature shows, conditioned management treatment has been analyzed in most studies as a complementary approach. This approach has been evaluated in cocaine, heroin, methadone and alcohol users. Findings of the present study are contradictory to the results of findings by Heli et al. (36). They found that the effectiveness of conditioned management treatment on

simultaneous cocaine-alcohol users had a similarity to the control condition. To explain the lack of therapeutic response in the study by Heli et al., creating synergies in combined use of cocaine and alcohol can be mentioned. In contrast, the study by Rash et al. (37) showed that conditioned management treatment was effective on simultaneous cocaine-alcohol users. Methodologic and demographic differences can be considered important in the contradiction of the findings. On the other hand, the results of the present study are in contrast with the results of the study by Killeen et al. (38) which examined the effectiveness of combining conditioned management treatment with standard social-oriented treatments in marijuana users. In comparing the results, while also taking into consideration the difference in the nature of these two substances, the difference in findings can be the result of interactive effects of multiple treatments. In addition, examining the social substrates is necessary in efficiency of social-oriented treatments. Meeting the costs of CM approach is one of the challenges of this treatment. In this case, the results of the study by Murphy et al. (39) showed conditioned management treatment is a wise investment in the struggle to quit stimulants. The present study was implemented with an approach of issuing coupons. The result of a study by Festinger et al. (40) showed, the effectiveness of conditioned management treatment based on paying cash (CBRT) proved to be more successful than the coupon method (VBRT). Although handing out cash has received a lot of criticism in the process of treatment, the results need more evaluation. A meta-analysis was carried out by Griffith et al. (2). They analyzed thirty studies conducted in the field of examining the effectiveness of conditioned management treatment on methadone users, and showed that conditioned management treatment has a total size effect of 0.25. In this regard, another meta-analysis was undertaken by Lusir et al. (9) during June 1991 to March 2004 in the case of examining the coupon strengthening treatment (VBRT), and the results showed that conditioned management treatment has total size effect of 0.32. This is consistent with the previous studies about the efficiency of this treatment compared to the control group.

5. Limitations

This study had several limitations. The most important restrictions were as follows: 1) the cross-sectional nature of the study limits the overall conclusion and comprehensive forecast; 2) using a self-report assessment in sensitive subjects often creates a favorable social image and thus, self-reporting is associated with possible bias; 3) The study was conducted within the context of a single site clinical trial. As such, the findings may not be applicable to other treatment-seeking populations; and 4) finally, the clinic was not able to provide records of attendance at counseling sessions, which precluded us from examining group differences in treatment attendance. Future research could address these issues

6. Conclusions

The results of the present study showed CM has a productive effect on increasing the rate of negative urine tests and decreasing craving for use, in cocaine users. The findings can have applicable importance in cases of accepting and implementing conditioned management treatment as an evidence-oriented approach. It is recommended in future studies that savings be considered for potential costs of CM. Also, it is recommended, a similar study be conducted on a sample of female cocaine users. Conducting a complementary study in the case of a clinical trial regarding the effectiveness of CM in terms of two approaches based on coupon and cash in a similar sample, can be appropriate.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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