

UPDATE ON TREATMENT OF CRAVING IN PATIENTS WITH ADDICTION USING COGNITIVE BEHAVIORAL THERAPY

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Abstract

Objective: The craving is a strong desire to consume a psychotropic substance and is one of the symptoms of withdrawal syndrome in drug addiction. As a theoretical construct, craving is complex and described by different authors, which results in various theoretical models, but there is a consensus on the importance of its treatment. This paper conducted a literature review to identify and describe the most widely used techniques of Cognitive Behavior Therapy for the management of craving and to verify the impact of applying these techniques on outcome variables, specifically the craving.

Method: Searches were conducted in the databases of PubMed and PsycInfo using the following descriptors in association: “craving”, “cognitive therapy”, “behavior therapy” and “cognitive behavior therapy”.

Results: 198 papers were found, out of which thirty four were selected for analysis. The cognitive behavior therapy treatment includes various techniques such as Relapse Prevention, Psychoeducational, Humor and Stress Management, Motivational Interviewing, Exposure to the Relapse Prevention and Relaxation techniques. The manual for Project MATCH is one of the most cited and used for the treatment of drug addicts. Cue Exposure Therapy (CET), Attentional Bias Modification (ABM) and newer “mindfulness” therapeutic methods are studied, and have shown promising results, but still need to be further investigated.

Conclusion: Various treatments have been proposed and have allowed the achievement of significant improvements in the reduction of craving.

Key words: addiction, craving, cognitive behavioral therapy

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Introduction

Drug addiction (DA) is considered one of the major public health problems, as it is a highly prevalent disorder, affecting about 10% of the world population, and it increases mortality, morbidity and health care costs (Unodc 2013).

Several factors may hinder drug abstinence and its maintenance over time. Among these factors, the most important are the withdrawal symptoms and craving, associated to the physiological effects of the lack of that substance in the body (Gilbert et al. 2000, Shapiro et al. 2002, Shiffman et al. 2004).

The craving is a symptom of withdrawal syndrome and is the result of neurochemical changes caused by the consumption of psychotropic substances and can be triggered as a result of exposure to internal or environmental cues.

As theoretical construct, craving is complex and described by different authors, who differ substantially on its concept and explanatory theory. Efforts also encompass conceptualization of the term's etiological explanations which result in various theoretical models.

From the emphasis on biological, psychological or environmental aspects, these models are based on various notions, from learning by conditioning to the motivational theories. The result is a range of mutually non-exclusive possibilities for the understanding of the same phenomena (for a review Drummond et al. 2000; Sánchez-Hervás et al. 2001, Skinner et Aubin 2010).

In addition, there is no consensus on its role within drug addiction. Some authors (Marlatt 1985, Tiffany 1999) claim that craving is an epiphenomenon, used only to explain the relapse. They do not acknowledge craving should be present for relapse to occur (Lowman et al. 2000, Drummond et al. 2000). They do not consider the predictive value of craving for the treatment. For instance, the Tiffany's model defines craving as non-automatic cognitive processing and explains episodes of craving after a longer abstinence (Tiffany 1999). Animal research models and functional imaging techniques are used to clarify neurobiological mechanisms and correlations between craving and drug addiction (Vukovic et al. 2008). The consequence directly affects treatment, which cannot adequately address craving.

Meanwhile, others regard craving as an essential component of drug addiction (Goldeinstein & Volkow 2002, Dackis & O'Brien 2005). According with these authors, craving is considered one of the main symptoms of drug addiction and their postulations are based on clinical observation. Several studies assessing the correlation between craving and relapse indicated that craving is a major risk factor for relapse after cessation of drug use (Hughes et al. 1999, Osler et al. 1999). Other studies investigate the effects of medication in decreasing craving and relate this decrease to abstinence and to a decrease in the drinking behavior.

For these reasons, the treatment of craving seems to be essential for the long-term recovery of patients suffering from substance abuse (National Institute on Drug Abuse 2009). The importance of craving as a symptom of addiction can be regarded from the fact that it was included in the fifth edition of the DSM as a diagnostic criterion for substance use disorders. In this manual craving was defined as a strong desire or urge to use a psychotropic substance (American Psychiatric Association 2013).

Despite the extensive knowledge accumulated about pharmacological treatment, there is limited availability of information about the psychotherapeutic approach to craving. Among psychological interventions aimed at drug addiction and craving management, cognitive therapies are among the most effective (Sánchez-Hervás et al. 2001).

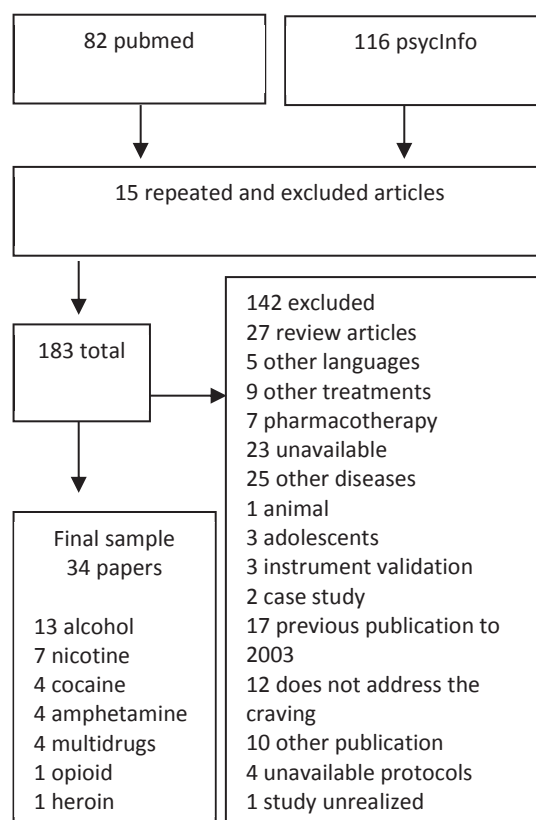
In this study we aimed to review the literature regarding the most widely used techniques of Cognitive Behavior Therapy for the management of craving on psychoactive substance related disorders and to compare them in terms of effectiveness. As such, we will begin from the assumption that craving is defined as a strong desire or need to consume a psychotropic substance.

Method

We conducted searches in the electronic databases of PubMed and PsycInfo using the following descriptors in association: "craving", "cognitive therapy", "behavior therapy" and "cognitive behavior therapy". Selected articles met the following inclusion criteria: i) original papers; ii) papers which are indexed and available in PsycInfo and PubMed databases; iii) papers in Portuguese, English and Spanish with abstracts available in the databases cited above; iv) papers published in the last 10 years or equivalent to the range from January 2003 to March 2013; v) papers which sample was comprised only by humans; vi) papers which sample was comprised of adults aged between 18 and 60 years of age.

We found 198 papers in both databases, out of which 15 papers were duplicates and therefore were excluded from the larger group. Studies involving literature reviews, exclusively pharmacological approach, case studies, treatment methods that do not involve psychological interventions, other populations (teenagers), studies that did not address craving as a symptom of addiction (craving for food and pathological gambling) or which goal was not its treatment, were excluded. Being papers to be entirely read, the sample consisted of 34 items that investigated the treatment for craving in addiction. The detailing of the papers that were excluded is given in **figure 1**.

Figure 1. Flow chart of literature search results for cognitive behavior treatment for craving, March 2013



Results

The collected data is summarized in **table 1**. Studies found in this search investigated mainly the treatment of craving for nicotine and alcohol. Study samples encompassed mainly male subjects, with three papers investigating more specific populations such as addiction with schizophrenia (Tidey et al. 2011), post-traumatic stress disorder (Coffey et al. 2006) and homosexual HIV carriers (HIV+, gay) (McElhiney 2009). The following results shall be presented according to the study design.

Cognitive Behavioral Therapy (CBT)

In cognitive behavioral therapy (CBT) programs, combinations of various techniques are common. Among the most frequent are: psychoeducation, stress and humor management, motivational interview, exposure and response prevention, relaxation techniques and relapse prevention. Five papers included design formed only by these techniques (Back et al. 2007, Loeber 2007, Kavanagh 2006, Shadel 2011, Witkiewitz et al. 2011).

Loeber et al. (2007) developed a brief cognitive behavior therapy (22.5 h) with coping strategies for handling high risk situations and aimed at strengthening the patients' abstinence in the experiment motivational group. Cue induced alcohol craving had a general reduction, but there was no significant interaction group over time.

Back et al. (2007) treated multi-drug dependents that underwent cognitive behavior stress management and demonstrated less stress-induced craving than a non-

treatment comparison group. The cognitive behavior stress management consisted of psychoeducation regarding stress, stress reactivity and the relationship between stress and substance use, cognitive restructuring, problem solving, relaxation training, experimental exercises, which are techniques that, when confronted with stress and/or craving, are to be used in place of administering alcohol or other drugs.

Kavanagh et al. (2006) conducted an alcohol abuse person study that compared CBT with CBT + Cognitive Exposure (CE) and CBT + Emotional Cognitive Exposure (ECE). The CBT consisted of training for self-control of alcohol use with emphasis on coping with negative mood. In CE and ECE, session one was identical to CBT and in the following sessions only 20 minutes were dedicated to CBT. CE was a condition with no affection-triggering stimuli in which the participants drank two shots of their favorite drink during the discussion of CBT material and then asked to resist another drink, exposure imagining a non-dysphoric situation in which they would normally drink it. ECE+CBT employed the same procedures as CE plus negative mood induction through recalling the unpleasant experience associated with excessive drinking. The CBT group showed little change over the stimuli presentation blocks, CBT+ CE showed a rise in the extent that craving decreased by the end of sessions and CBT + ECE showed a benefit in the mid-treatment stimuli-presentation blocks which was not maintained.

Shadel et al. (2011) conducted a cognitive-behavioral-therapy-based study with monitoring of each participant's progress and a lecture on some theme of smoking cessation, such as self-monitoring, stimulus control, cognitive coping. After being 48h abstinent, under the lapse condition (smoking two cigarettes of their preferred brand during a 30-min period), relapse was more frequent due to episodic increases in craving among the participants under this condition in comparison to a no-lapse condition (a no smoking, 30-min waiting period after 48h abstinent).

Witkiewitz et al. (2011) compared two groups of multi-drug users. All participants received CBT, which included motivational interviewing, functional analyses and individualized intervention with assertion skills training, communication skill training, coping with craving and urges, drink refusal and social pressure skill training, job finding training, mood management training, mutual help group involvement, social and recreational counseling and social support for sobriety. The experiment group received a module focused specifically on coping with craving and urges. This module incorporated a description of the rationale that experiences of urges and craving are predictable and can be controlled, an assessment of the particular cues or situations that elicit craving or urges, an urge-monitoring homework assignment and psychoeducation on strategies for coping external triggers. There were no differences on self-reported craving among the participants that received the craving module (Witkiewitz et al. 2011).

CBT in virtual format was compared to Virtual reality therapy (VRT) in treatment for alcoholism. The virtual reality therapy (VRT) consisted of a series of scenes that were associated with relaxation, simulating a high-risk situation (virtual alcohol cues) and then an aversive stimulation. The results showed that VRT was superior to CBT in reducing the craving after the 10th VRT session (Lee et al. 2008).

The application of all these techniques was mainly in the treatment of alcoholism and was effective on decreasing in the cue-induced craving (Loeber et al.

2007, Kavanagh 2006). There was much improvement regarding the craving for alcohol (Shadel 2011, Witkiewitz et al. 2011) even when it was induced by stress (Back et al. 2007).

CBT Match Protocol

One of the most cited manuals to guide treatment programs for the treatment of drug addiction is the handbook of Cognitive-Behavioral Therapy developed by Project MATCH (Kadden et al. 1992). Match Protocol included Cognitive Behavioral Coping Skills Therapy, Motivational Enhancement Therapy or Twelve-Step Facilitation Therapy. This protocol was used in five papers (Balldin et al. 2003, Gardia et al. 2004, Anton et al. 2005, Dackis et al. 2005, Greenfield et al. 2010).

Balldin et al. (2003) applied the CBT match protocol compared with ST – “treatment as usual” – to be supportive and to motivate into sobriety without teaching specific coping skills for alcohol dependence. Four groups were formed (CBT+naltrexone/ CBT+placebo/ ST+naltrexone/ ST+placebo) and the most favorable outcome in regard to craving was observed in CBT+ naltrexone treatment.

Gardia et al. (2004) treated alcohol dependents with 12 sessions of CBT match protocol combined with olanzapine or placebo. Both groups had a reduction of craving, but no statistical differences were observed when comparing patients treated with olanzapine and placebo.

Anton et al. (2005) picked random alcoholic outpatients in one from four conditions (CBT plus placebo/ CBT plus naltrexone/ MET plus placebo/ MET plus naltrexone) and observed that all factors associated with craving were reduced in the group treated with CBT and naltrexone. The treatment was based in MATCH protocol.

Dackis et. al (2005) treated cocaine dependence with modafinil or placebo and CBT based in MATCH protocol. Each group showed a greater initial decline in scores, and there were no significant group differences observed at any point in the intensity or frequency of craving.

Greenfield et al. (2010) treated alcohol dependence with medical management, placebo, naltrexone, acamprosate or a combination of them with or without a CBT based on MATCH protocol. Only naltrexone alongside behavioral intervention interaction was significant in reduction of alcohol craving compared to placebo-treated subjects.

In short, Match Protocol based CBT was effective in reducing craving, (Greenfield et al. 2010, Anton et al. 2005). There was no reduction in the frequency and intensity of episodes of craving when this protocol was applied to the treatment of cocaine dependence in association with modafinil (Dackis et al. 2005).

Community Reinforcement Approach (CRA)

The cognitive behavioral treatment based on the Community Reinforcement Approach (CRA) was applied in the treatment of tobacco use in only one paper (Roozen 2006). CRA consists of motivational interview techniques, adherence to medication training, self-monitoring, skill training, functional analyses, planning activities associated with naltrexone and nicotine replacement therapy. A study shows that the use of CRA reduced significantly the craving for cigarettes and led to almost twice the abstinence rate the one observed in the group treated only with naltrexone in a 3-month follow-up (Roozen et al. 2006).

Other psychological interventions

CBT has also been directly compared with other psychological interventions in two papers (Weiss et al. 2003, Lee et al. 2010). When compared to self-help booklets, CBT was not more effective in reducing craving (Lee et al. 2010). In the treatment of cocaine dependence, a condition of individual drug counseling (based on the 12-step philosophy of treatment) plus group drug counseling (patients were educated in addiction recovery and strongly encouraged to participate in the 12-step group) was the most effective treatment in the study, more than cognitive therapy and a supportive-expressive psycho-dynamic therapy (focused on the importance of core interpersonal and intrapsychic themes in the genesis and maintenance of cocaine use) and might have additionally weakened the link between cocaine craving and subsequent use (Weiss et al. 2003).

CBT and pharmacotherapy

Designs in which CBT was used in combination with pharmacotherapy in the treatment of addiction to alcohol, tobacco, cocaine and amphetamines were also found. The results were inconsistent regarding the reduction of craving in patients treated with olanzapine and TCC (García et al. 2004). There was no evidence that modafinil reduced cocaine craving (Dackis et al. 2005), while the associated amlodipine and CBT did not present any advantage over placebo for craving (Malcolm 2005 et al.). Modafinil associated with CBT reduced the craving rates for amphetamines (McElhiney et al. 2009). The ondansetron did not decrease craving for methamphetamine compared to placebo-treated group and therapy (Johnson et al. 2008). In co-abusers of cocaine and alcohol, disulfiram was more effective in preventing the consumption of both drugs and reducing the craving for cocaine (Grassi et al. 2007) while naltrexone was more effective in reducing the craving for alcohol (Grassi et al. 2007).

Other studies (Anton et al. 2005, Schmitz et al. 2008, Greenfield et al. 2010) observed the impact of medication or placebo and CBT or another therapy under various conditions. Associations between 8 different treatments (Medical Management with 16 weeks of placebo, active naltrexone and placebo, active acamprosate, with or without a specialist-delivered CBT), the medical management plus naltrexone condition (no CBT specialty therapy), or medical management plus CBT (no naltrexone), led to more reduction in craving for alcohol than those administering placebo or any of the other individual or combination treatments (Greenfield et al. 2010). Among other combination treatments studied (levodopa/carbidopa or placebo delivered in combination with Clinical Management; Clinical Management + cognitive behavioral therapy; or Clinical Management + CBT + voucher-based reinforcement therapy), the association of Levodopa + CBT+ voucher-based reinforcement therapy reduced craving when compared to placebo treatments (Schmitz et al. 2008). Naltrexone combined with CBT was superior to placebo in reducing craving and was superior to other conditions (CBT plus placebo; CBT plus naltrexone; MET plus placebo; MET plus naltrexone) (Anton et al. 2005).

Cue Exposure Therapy (CET)

The Cue Exposure Therapy (CET) was also one

of the interventions used for the treatment of craving. The CET involves controlled and repeated exposure to drug-related stimuli, aimed at reducing the reactivity to further stimuli by extinction and habituation. The CET should start with less reactive stimuli and go up along the time of treatment. We found 6 papers that used this treatment (De Quiros et al. 2005, Lee et al. 2007, Marissen et al. 2007, Price et al. 2010, García-Rodríguez et al. 2012, Yoon et al. 2013).

The CET has been shown to be effective in reducing the craving for alcohol. Lee et al. (2007) conducted CET using virtual reality with participants of alcoholics anonymous for eight sessions. Each session was oriented with a specific theme about the people, objects and situations that elicit craving. The results indicated a reduction in cue elicited craving and suggest that virtual reality can enhance the effectiveness of CET.

In the treatment for opioid dependence, the CET was compared with placebo or routine treatment and held significant reduction in conditioned responses to drug related stimuli, as negative affect (craving) (De Quiros et al. 2005). The experiment group underwent a program which included relapse prevention, learning how to detect high risk situations, social skills training and gradual cue-exposure program to drug-related stimuli.

Also, opioid craving was reduced in a protocolized CET, in which the experiment group was subjected to an exposure to highly individualized drug related stimuli with response prevention (Marissen et al. 2007). However, the experimental and control group responded with a similar decrease in craving.

Price et al. (2010) subjected methamphetamine dependents to in vivo exposure of paraphernalia and simulated methamphetamine as well as photographs and video of individuals procuring and using methamphetamine. The authors observed that the cue-elicited methamphetamine craving was extinguished after two sessions of exposure.

For smoking cessation, cue-induced craving was extinguished following repeated sessions of CET using virtual smoking cues, and daily smoking craving decreased during the treatment period (García-Rodríguez et al. 2012, Yoon et al. 2013). García-Rodríguez et al. (2012) conducted a study with a group of smokers exposed to seven virtual environments involving common situations and specific cues that produce smoking craving. The authors observed that exposure to smoking relates cues throughout the virtual environments were able to generate craving, while no increase was observed for the neutral environments.

Yoon et al. (2013) compared two groups (CBT+CET+D-cycloserine/ CET+D-cycloserine) and observed that smoking craving was not affected by D-cycloserine in cocaine and nicotine dependents. In this study, the CET consisted of real-life scenarios, smoking cues and neutral scenarios from a first-person perspective. Participants had access to their preferred cigarette brand and asked to manipulate and smell it.

Mindfulness

The Mindfulness was yet another treatment used in three papers (Bowen et al. 2009, Witkiewitz et Bowen 2010, Rogojanski et al. 2011). Mindfulness techniques were compared to suppression techniques for the treatment of smoking cessation, but none of the interventions significantly reduced craving after exposure to conditioned cues (Bowen et al. 2009).

However Bowen et al. (2009) observed a significant

reduction in craving compared to standard treatment. Mindfulness-based relapse prevention decreased craving more than standard treatment (Bowen et al. 2009). Witkiewitz et Bowen (2010) conducted a study with randomly picked multidrug users which participate in 8 weekly sessions of MBRP or a standard treatment control group. The results indicated that the MBRP group had lower craving score, but this result was not

statistically significant.

Rogojanski et al. (2011) compared participants in a smoking cue exposure in two conditions: mindfulness (to accept the thoughts and feelings that a rise a mindful way) or suppression (to distance themselves from the experience by actively avoiding thoughts and feelings that a rise). None of the interventions reduced the craving significantly after induction of conditioned cues.

Table 1. Summarized results of the PsycInfo and PubMed databases selected papers

Articles		n	Male (%)	Techniques	Medication	Intervention control	Outcome on craving
Balldin et al. 2003	alcohol	118	73	Based CBT Match Protocol	Naltrexone or placebo	Supportive Therapy	The association CBT + naltrexone was better for reduced craving than CBT + placebo or supportive therapy and naltrexone or placebo.
Malcolm et al. 2005	cocaine	195	79	Craving management, problem solving, monitoring activities, relapse prevention.	Amlodipine or placebo	No	Amlodipine + CBT did not show any advantage over placebo + CBT for craving.
Kavanagh et al. 2006	alcohol	163	43	Motivational interviewing, psychoeducational, problem solving, humor management, monitoring activities, relapse prevention, exposure and response preventions.	no	cue exposure (CE) or emotional cue exposure (ECE)	CTB group showed little change in the craving over the blocks, CBT+ CE showed a rise in the extent that craving decreased by the end of sessions and CBT + ECE showed a benefit in the middles block which was not maintained.
Gardia et al. 2004	alcohol	60	76	based CBT Match Protocol	Olanzapine or placebo	No	There was no significant reduction of the craving in both treatment conditions associated with CBT.
Dackis et al. 2005	cocaine	62	70	Based CBT Match Protocol	Modafinil or placebo	No	No were observed significant differences at any point in the intensity or frequency of craving in the both groups.
Johnson et al. 2008	Metam-phe-tamine	150	65	training for adherence to a treatment e relapse prevention.	Ondan-setron or placebo	No	The craving methamphetamine not reduced for ondansetron and therapy.
McHughet al. 2010	nicotine	51	65	attentional bias modification	no	Exposure untrained vies for attention	The attentional training bias did not result in a significant decrease in attentional bias or craving reactivity.
Field Duka Tyler Schoenmakers 2009	nicotine	72	54	attentional bias modification	no	reducing attentional bias (avoid smoking group) or control group in whom attentional bias was not manipulated.	The craving has increased over time, but the attention in training had a significant impact.
Schoen-makers et al. 2010	alcohol	43	77	attentional bias modification	no	Exposure untrained vies for attention	The ABM no significant effects in craving when compared with exposure untrained.
Back et al. 2007	multi-drugs drogass	20	35	psychoeducational, stress management, problem solving, relaxation techniques.	no	No	Cognitive behavioral stress management intervention lead to significant improvements in stress-induced craving.
Rogojanski Vettese Antony 2011	nicotine	61	59	mindfulness	no	Suppression	None of the interventions reduced the craving significantly after induction of conditioned cues.
Loeber et al. 2006	alcohol	63	57	psychoeducational, relapse prevention, craving management, motivational interviewing.	no	CET	The results indicated a general reduction in cue-induced craving, but not have a significant interaction group X time.
Marissen et al. 2007	heroin	127	–	Cue exposure therapy	no	placebo psycho-therapy	Both groups, craving for heroin decreased after the cue exposure therapy compared to baseline.

Table 1. Continued

Lee et al. 2007	alcohol	8	–	Cue exposure therapy	no	no	The cue exposure treatment reduced the craving.
Witkiewitz et al. Bowen 2010	multi-drugs drogas	168	64	mindfulness-based relapse prevention	no	treatment as usual (TAU)	The MBRP group had lower craving score, but this result was not statistically significant.
Tidey et al. 2011	nicotine and schizophrenia	57	71	contingency management (CM)	Bupropion or placebo	non-contingent reinforcement	The craving reduced over the weeks in the contingency management group.
Yoon et al. 2013	nicotine cocaine	29	83	Cue exposure therapy and Cognitive Behavior Therapy	D-cycloserine or placebo	Virtual cue-exposure therapy	Craving decreased across study days and cue-induced craving was extinguished following repeated sessions of CET using virtual smoking cues. But these changes no effect of D-cycloserine on the primary dependent measures.
Roozen et al. 2006	Nicotine	25	72	Community Reinforcement Approach	Naltrexone or NTR	Relapse prevention	The craving decreased significantly in the CRA group, but the role of medications is unclear and a methodological limitations.
De Quirós Labrador and De Arce 2005	opiod	24	75	Cue exposure therapy	no	routine treatment	The experimental group had a significant reduction of the craving during scenes related to drug after 6 months of follow-up. There was no reduction in the control group submitted a routine treatment.
Price et al. 2010	Metamphetamina	28	20	Cue exposure therapy	no	no	The craving reduced significantly.
Greenfield et al. 2010	alcohol		69	Based CBT Match Protocol	Naltrexone or placebo and acamprosate or placebo	medical management	The craving naltrexone group reduced more than in the placebo group.
Lee et al. 2010	Metamphetamina	214	–	cognitive-behavior therapy and motivational interviewing	no	self-help booklet	There was no significant reduction in the craving.
Shadel et al. 2011	tobacco	63	47	cognitive-behavioral intervention and self-help materials	no	no	Group no-lapse condition (a no smoking, 30-min waiting period after 48h abstinent) not experienced changes in their craving, participants in the lapse condition (smoking two cigarettes of their favored brand during a 30-min period) experienced a significant decrease in craving pre- to post manipulation.
Schmitz 2008	Cocaine	161	63	Relapse prevention, craving management, monitoring activities, anger management, social skills training, problem solving (CBT)	Levodopa or placebo	Voucher-based reinforcement therapy + CBT (VRBT)	The group treated with Levodopa + VBRT + CBT had less craving compared to patients assigned to placebo or levodopa an another conditions (CBT + ClinMan or CBT + ClinMan + VRBT).
Bowen et al. 2009	Álcohol	168	64	guided meditations (mindfulness-based relapse prevention)	no	treatment as usual (TAU)	The craving was greater reduction in relapse prevention group undergoing based on Mindfulness.
Witkiewitz Bowen and Donovan 2011	alcohol	776	69	Motivational interviewing, craving management, Psychoeducational.	no	no	The negative mood associated with craving reduced significantly.
Anton et al. 2005	alcohol	160	75	Based CBT Match Protocol	Naltrexone or placebo	motivational enhancement therapy (MET)	All factors associated with craving were reduced in both groups, but those treated with CBT and naltrexone were more reduction of craving.

Table 1. Continued

McElhiney 2009	amphet- amina	16	–	Coping with crav- ing, social skills training, problem solving, monitoring activities, practice safe decision mak- ing, relapse preven- tion	Modafinil followed of placebo	no	The craving declined substantially for responders.
Lee et al. 2008	alcohol	20	100	Virtual reality therapy	no	Cognitive be- havioral therapy (nVRTP)	The group VRTP exhibited a greater decrease in craving after the 10th VRTP session, when compared to the nVRTP.
Grassi et al. 2007	cocaine alcohol	12	–	Trans-theoretical Model of Change, as described by Prochaska and Di Clemente	Disulfiram or Naltrex- one	no	Both DIS/CBT and NTX/CBT groups scored significantly lower than CBT group for cocaine craving, whereas alcohol craving was lower in the NTX/CBT group.
Weiss Griffin Mazurick et al. 2003	cocaine	449	77	cognitive therapy individual format that emphasized the importance of mal-adaptive beliefs and cognitions in addiction.	no	individual drug counseling (12 step philosophy)/ supportive ex- pressive psycho- dynamic/group drug counseling (12 step)	The condition of individual drug counseling + group drug counseling was the most effective treatment when compared with supportive-expressive psycho- dynamic therapy + group drug counseling condition and CBT + group drug counseling condition and group drug counseling alone. Craving not assessed from pre- to- post treatment, but the study observed that the condition of individual drug counseling plus group drug counseling might have weakened the link between cocaine craving and subsequent use.
Loeber et al. 2007	alcohol	43	51	motivational inter- viewing, relapse prevention, craving management	no	no	The results indicated a general reduction in cue-induced craving from pre- to- post treatment assessment.
Coffey Stasiewicz Hughes and Brimo 2006	alco- hol+ PTSD	43	33	trauma-focused imaginal exposure	no	imagery-based relaxation	Mean craving ratings elicited by the trauma image/alcohol cue decreased significantly in the exposure condition, but did not change appreciably in the relaxation condition.
García Rodríguez et al. 2012	Nico- tine	90	52	Cue exposure therapy (CET)	no	no	Exposure to smoking-related cues throughout the virtual environments had medium-to- large effects on craving increases.

Attentional Bias Modification (ABM)

The Attentional Bias Modification (ABM) was used in 3 of the assessed studies (Field et al. 2009, McHugh et al 2010, Schoenmakers et al. 2010). McHugh et al (2010) applied attentional bias modification-based treatment on nicotine dependents compared to a similar group untrained for attentional bias and exposed to the same stimulus. Results indicated significant decrease in attentional bias or craving reactivity.

Field et al. (2009) compared the effects of increasing attentional bias (attend a smoking group) and reducing attentional bias (avoid smoking group), with a control group whose attentional bias was not manipulated among tobacco smokers. The results pointed that there were no significant effects of ABM on either index of subjective cigarette craving.

Schoenmakers et al. (2010) conducted study with alcohol dependents which were randomly assigned either to an ABM intervention or control training. The procedure consisted of five sessions in which patients

were trained to disengage attention from alcohol-related stimuli (ABM condition) or in which they were trained on an irrelevant reaction time test (control condition). ABM weakened the associations of alcohol-related cues, a generalized fact in relation to new stimuli, but there were no significant effects on subjective craving.

Contingency management (CM)

Contingency management (CM) interventions involve providing a tangible reinforcement upon objective confirmation of drug abstinence or another target behavior. A single study was found (Tidey et al. 2011). Tidey et al. (2011) treated smokers with schizophrenia. They were randomly selected to receive either bupropion or placebo and, a week later, participants were randomly assigned to a contingency management (CM) intervention in which either reductions in urinary cotinine levels were reinforced, or a non-contingent reinforcement (NR) condition in

which session attendance was reinforced, regardless of cotinine level. In all patients the craving decreased, but not significantly.

Trauma-Focused Imaginal Exposure

Alcohol dependents with Post Traumatic Stress Disorder (PTSD) were treated with trauma-focused imaginal exposure. Mean craving ratings elicited by the traumatic image/alcohol cue decreased significantly in the exposure condition, but did not change appreciably in the relaxation condition (Coffey et al. 2006).

Discussion

In the present study we conducted a literature review on the existing techniques of Cognitive Behavior Therapy for the management of craving, one of the main symptoms of addiction.

One of the most frequently applied treatments was CBT. This treatment consisted of several techniques such as psychoeducation, stress and humor management, motivational interview, exposure and response prevention, relaxation techniques and relapse prevention. The CBT Match protocol was proven effective in reducing craving for drugs. Its effectiveness is enhanced when combined with pharmacotherapy, especially naltrexone, which effectiveness has been observed in other studies (Volpeccelli et al. 1992). But modafinil, ondansetron and disulfiram reduced the craving for amphetamine, methamphetamine and cocaine, respectively. The positive results were superior to other treatments which were based only on self-help booklets and other purely motivational or psychosocial interventions based on the 12-step philosophy for treatment. McHugh et al. (2010) suggest that the CBT effectiveness varies with the used drug: greater effectiveness for treatment of cannabis, followed by moderate effectiveness in treatments for cocaine and opioids, and the smallest effectiveness for polysubstance dependence.

Few studies have assessed CET. In these studies, significant craving reductions were observed in addictions to alcohol, amphetamines, tobacco, opioids. CET was shown to be effective in reducing craving, but the literature data available indicate limitations on the application of CET, once CET was limited in the promotion of abstinence, alongside increased relapse rates in subjected patients (Brandon et al. 1995, Niaura et al. 1999, Shiffman and Ferguson 2009). Other studies show the effectiveness of CET in the extinction of conditioned stimuli to the drug and consequent reduction in craving (O'Brien et al. 1990, Field and Duka 2002). There are efforts to improve its effectiveness applied to addiction (Conklin & Tiffany 2002), so that conclusions about its effectiveness would be precipitate.

Similarly, Mindfulness-based interventions were effective in reducing craving. The literature data have shown reduction in craving, including positive impacts on neural aspects of craving (Westbrook et al. 2011). In general treatment of drug addiction, mindfulness reduced the consumption of several substances including alcohol, cocaine, amphetamines, marijuana, cigarettes, and opiates (Serretti and Chiesa 2014). But we point out the need for additional studies that replicate other results for the application of mindfulness in the treatment and management of craving.

The Attentional Bias Modification had no significant impact on reducing nicotine and alcohol craving. ABM weakened associations related to drug cues, but its

changes were transient and little generalized (Field et al. 2009). Other studies have also shown that Attentional Bias Modification reduced craving (Field et al. 2007) and alcohol consumption in groups trained to divert the attention of the drug-related stimuli (Field and Eastwood 2005). In this sense, such training was effective in modifying the responses to stimuli conditioned to drugs (Attwood et al. 2008), but their results should be interpreted with caution. Still, its application may contribute to increased effectiveness of cognitive behavioral therapy-based treatment (Schoenmakers et al. 2010).

In summary, the treatment of craving is one of the essential steps in the treatment of addiction. The complexity and multi-factor nature of craving make its understanding and treatment complex. The result is a wide variety of theories, explanatory models and available treatments, which should be used according to the patient's profile, needs and resources, as well as the history and severity of their disease. It is worth mentioning the importance of assessing the impacts and benefits of applying those resources and the need to combine them to obtain the best therapeutic result.

Taking into account the unavailability of some papers as a limitation of our results, we point out the need for other papers that consider the treatment of craving subtypes and compare the effectiveness of psychological interventions applied to each one of them.

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