Revisión

Craving: explanatory models, associated factors, and therapeutic approaches: A systematic review

Psycoespacios

Craving: modelos explicativos, factores asociados y abordajes terapéuticos: Revisión sistemática de literature

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Abstract: Introduction: the diagnostic criteria of craving for substance use addition disorder was included in the Diagnostic and Statistical Manual of Mental Disorders DSM-5 in 2013. However, this remains a complex phenomenon that requires further attention. Objective: the present study aimed to review explanatory models of craving, describe the factors involved in the anxiety of maintaining an addictive behavior and point out the treatments that have been proposed so far to control craving. Method: systematic review of literature oriented according to the criteria of Cochrane Collaboration, included 100 articles selected from keywords and Boolean search engines in the databases of Scielo, Dialnet, Scopus, PubMed, Web of Science and EBSCOhost. Results: craving represents a phenomenon of great complexity underlying all kinds of addictive behavior, which is interpreted from different models such as: neurobiological, tolerance and abstinence, emotional regulation, learning and conditioning, information processing and meeting needs. Likewise, multiple factors associated with the phenomenon are evident from the cognitive, emotional, social and environmental aspects, forcing the search for and implementation of therapeutic approaches of a broad range from pharmacological, cognitive-behavioral to innovative with virtual reality and mindfulness. Conclusions: contribution of the diagnostic criteria of craving obliges to consider the integral and interdisciplinary intervention and prevention processes, aimed at addressing biopsychosocial and environmental factors and aspects to optimize recovery and prevent relapses in both chemical and behavioral addictions.

Keywords: craving, chemical and behavioral addictions, explanatory models, biopsychosocial factors, therapeutic approaches.

Resumen: Introducción: el criterio diagnóstico de craving para el trastorno de adición por consumo de sustancias fue incluido en el Manual Diagnóstico y Estadístico de los Trastornos Mentales DSM-5 en al año 2013; sin embargo, este sigue siendo un fenómeno complejo que requiere de una mayor atención. Objetivo: el presente estudio se orientó a revisar

modelos explicativos del craving, describir los factores que intervienen en la ansiedad de mantener un comportamiento adictivo y puntualizar los tratamientos que se han propuesto hasta el momento para controlar el craving. Método: revisión sistemática de literatura orientado según los criterios de colaboración Cochrane con 100 artículos seleccionados a partir de palabras clave y buscadores booleanos en las bases de datos de Scielo, Dialnet, Scopus, PubMed, Web of Science y EBSCOhost. Resultados: el craving representa un fenómeno de gran complejidad subyacente a todo tipo de comportamiento adictivos, que se interpreta desde distintos modelos: neurobiológico, de tolerancia y abstinencia, de regulación emocional, de aprendizaje y condicionamiento, de procesamiento de información y de la satisfacción de necesidades. Igualmente, se evidencian múltiples factores asociados al fenómeno desde los aspectos cognitivos, emocionales, sociales y ambientales, obligando buscar e implementar abordajes terapéuticos de un amplio diapasón desde los farmacológicos, cognitivo-conductuales hasta innovadores con empelo de realidad virtual y mindfulness. Conclusiones: el criterio diagnóstico del craving obliga a considerar los procesos de intervención y prevención integrales e interdisciplinarios orientados al abordaje de factores y aspectos biopsicosociales y ambientales para optimizar la recuperación y prevenir las recaídas en las adicciones tanto químicas como comportamentales.

Palabras clave: craving, adicciones químicas y comportamentales, modelos explicativos, factores biopsicosociales, abordajes terapéuticos.

Introduction

In contemporary society, addictive behaviors are a relevant and worrying issue. Currently, addiction is not limited to the use of substances such as alcohol or drugs, but encompasses a variety of addictive behaviors, such as gambling, food, technology, work, sex, and other problematic behaviors (Kumar et al., 2023; Portilho Carvalho et al., 2023; Penfold & Ogden, 2023).

Regarding substance addictions, it is important to note that, despite efforts to prevent and treat them, these remain a mental health problem in the general population. Addiction to illegal drugs, such as opioid use, as well as addiction to alcohol and prescription drugs, continue to affect many people. According to the UNODC —United Nations Office on Drugs and Crime— World Drug Report 2022, "some 284 million people aged 15-64 used drugs worldwide in 2020, an increase of 26 per cent over the previous decade" (United Nation, 2022, parr. 36).

In addition to the above, the excessive use of electronic devices, social networks, video games and online navigation has become a growing problem, configuring the problematic of the addition to technology. Dependence on technology often results in mental health problems, such as anxiety and depression, and can affect interpersonal relationships. Social networks have created an environment where young people seek validation and approval through obtaining "likes", followers and comments. This can lead to social media addiction and excessive concern for online image (Cemiloglu et al., 2022; Kumar et al., 2023; Portilho Carvalho et al., 2023).

On the other hand, in contemporary society, an old problem related to gambling addiction has been reinforced with online gambling and online gambling, by accessibility to online gambling platforms, causing multiple financial, family and personal problems (Penfold & Ogden, 2023; Sirola et al., 2023).

Economic abundance, especially in developed countries, has made it possible to increase food addiction, particularly to foods high in sugars and fats, causing health problems such as obesity and food-related diseases. Processed foods and fast food are often highly palatable and can be difficult to resist (Carbone et al., 2023; Miranda-Olivos et al., 2023; Whatnall et al., 2022).

Likewise, contemporary society often promotes a culture of overwork, where people feel pressured to work long hours and be always connected. This can lead to work addiction and affect people's health and well-being (Bereznowski et al., 2023; Kun et al., 2023). The easy access to online pornography and hyper-sexualization of contemporary society have contributed to sex addiction and pornography in some people (Bőthe et al., 2023; Sahithya & Kashyap, 2022).

In addition to the mentioned problems, there are other behavioral addictions, such as addiction to shopping, which is also promoted by the consumerist philosophy of contemporary society; to self-harm, vigorexia, emotional or affective dependence, and other harmful behaviors that affect people's mental health (Nyrhinen et al., 2023; Sanches & John, 2019; Araújo dos Santos et al., 2021).

The above information is associated with the global presence in the young generations of a mentality of instant gratification, promoted by contemporary society, where young people may be less willing to wait or strive for long-term rewards. This may increase the propensity to develop addictive behaviors (Saha & Dhenwal, 2023).

Considering this panorama, it is very important to understand different factors associates with the emergence and maintenance of addictive behaviors in the human being. Among these, the phenomenon of craving occupies a very relevant place.

The term *craving* refers to a strong desire or intense longing for something. It is usually used in the context of an intense desire to consume something, such as food, drink, drugs, tobacco, or even pleasant experiences. Cravings are common in various situations, such as specific food cravings, the desire to smoke a cigarette if you are a smoker, or the craving for an addictive substance. Cravings can be difficult to resist and can lead to impulsive behaviors if not managed properly (Tadros, 2023).

In case of a chemical addiction, when a person becomes addicted to a substance, such as alcohol, illegal drugs, prescription drugs or tobacco, his brain undergoes significant changes in the way it processes pleasure and reward (Heilig et al., 2021).

These changes can lead to the development of an uncontrollable and intense desire to consume the addictive substance, which is known as *craving* (Månsson et al., 2024). The relationship between craving and substance use becomes a circuit that is often difficult to break. Repeated use of addictive substances alters brain chemistry and can affect the way how released the pleasure-related neurotransmitters, such as dopamine. These changes may increase the sense of reward associated with substance use (Chen et al., 2023; Heilig et al., 2021). In addition to the above, the brain establishes the conditioning when associate certain stimuli, such as places, people or situations with the experience of consuming the substance and stimulates the experimentation of an intense craving when faced with these stimuli (Kulkarni et al., 2023a; Silverman et al., 2023). Over time, as tolerance to a certain substance develops, a person needs to consume more for experience the same effects. When the person tries to stop using the substance, gets to experience withdrawal symptoms, which, in turn, can increase craving and urgency to use the substance again to relieve symptoms. In this respect, craving is part of a reward cycle in the brain that is often difficult to break. When craving is satisfied and the substance is consumed, relief or pleasure is temporarily experienced, which reinforces addictive behavior (Khedr et al., 2023).

It is important to note that the term *craving* not only applies to addictive behaviors to psychoactive substances, but also to addictions or problematic behaviors not related to substances, such as gambling addiction, sex addiction, food addiction, use of technology, among others. In these behavioral addictions, craving manifests as an overwhelming desire to participate in addictive behavior (Leiva-Gutiérrez & Urzua, 2018). For example, people with gambling addiction may experience a strong craving for the thrill of gambling, often accompanied by obsessive thoughts about gambling and an uncontrollable urge to place bets (Sirola et al., 2023). In sex addiction, craving can manifest as an obsessive desire to seek sexual experiences, watch pornography or engage in compulsive sexual behaviors (Bőthe et al., 2023; Sahithya & Kashyap, 2022). In food addiction, craving results in an intense desire to consume specific foods, especially those considered "triggers" for food compulsion (Carbone et al., 2023; Ruiz et al., 2023; Thomas et al., 2023; Whatnall et al., 2022). People with shopping addiction may experience craving when they feel the urge to shop, either in person or online, to relieve anxiety or feel better (Nyrhinen et al., 2023; Sathya et al., 2023; Thomas et al., 2023). In technology addiction, craving can manifest as an uncontrollable desire to constantly check mobile phones, social networks or play online video games, among others (Cemiloglu et al., 2022; Kumar et al., 2023).

Craving is an important component of addiction and can be one of the biggest challenges for whom trying to overcome it. As in substance addictions, in behavioral addictions craving can be overwhelming and difficult to control. Craving management is a crucial aspect in recovering from addictions and usually requires therapeutic support, coping strategies and changes in the environment to avoid triggers that generate intense desires to consume some substance or carry out specific behaviors (Leiva-Gutiérrez & Urzúa, 2018; Serre et al., 2023).

To reveal this phenomenon and help people with any type of addiction to manage craving efficiently and personalized, it is necessary to deepen the compression of biopsychosocial factors associated with its emergence and maintenance.

In this way, Konova and Schweitzer (2023) describe that the determinants associated with craving are multiple, being these genetic, environmental, social, personality and mental illness factors.

Craving in chemical and behavioral addictions is a complex phenomenon that may be related to multiple biopsychosocial factors associated with the appearance and maintenance of craving in both types of addictions (Baxley et al., 2023; Kakko et al., 2019).

As for biological factors, it is important to highlight the role of brain neurochemistry, where imbalances in neurotransmitters, such as dopamine, serotonin and glutamate play an important role in regulating craving in addictions through the participating in the reward and pleasure circuits in the brain (Kakko et al., 2019).

There is evidence that genetic predisposition can influence the vulnerability to developing addictions and craving intensity, because some people may have a greater genetic susceptibility to experiencing intense cravings for substances or engaging in addictive behaviors (Graczyk et al., 2023). On the other hand, repeated substance uses or involvement in addictive behaviors can lead to changes in brain structure and function, which can increase craving intensity. This includes brain plasticity and adaptation to the presence of the substance or addictive behavior (Popescu et al., 2019).

Among the psychological factors associated with craving, it can be mentioned the learning and conditioning, both classical and operative: the associations between certain stimuli and the reward obtained through the consumption of substances or the performance of addictive behaviors, that can lead to a conditioned desire to repeat those experiences (Gong et al., 2021).

From the psychological aspect, it is also necessary to consider emotional elements, because stress, anxiety, depression and other emotions can trigger or intensify craving. Some people may use addictive substances or behaviors to deal with these emotions, which can increase the desire to consume or engage in addictive behavior. On the other hand, expectations about the positive effects of the substance uses or addictive behavior can increase anxiety and the desire (Gong et al., 2021; Guo et al., 2022).

Finally, social factors can be represented by the social environment, where peer pressure, availability of substances and exposure to people or situations related to addiction can influence craving. The social environment facilitating access to the substance or addictive behavior can act as a trigger for the desire to consume substances or engage in addictive behavior. In this case, cultural norms that normalize or encourage substance use or certain addictive behaviors can influence anxiety and desire. On the other hand, having a strong social support system can help reduce craving and facilitate recovery. Lack of social support or pressure from shared relationships can be additional challenges (Dehghan et al., 2023; Gong et al., 2021).

The interaction of these biopsychosocial factors is unique to each person and may vary depending on the type of addiction and the individual response. It is important to consider these factors and employ a holistic approach that includes therapy, medical treatment, social support and coping strategies to effectively address craving in addictions. Cognitive behavioral therapy and behavior modification therapy are common approaches used in craving management in addictions (Fachner et al., 2023).

Based on the above, the present study was aimed to systematizing the scientific evidence, published in the last 5 years, about the variables that influence the appearance of craving, addressing factors related to the individual, family and sociocultural dimension.

The present bibliographic review was oriented to revising explanatory models of craving, describe the factors associated with craving and pinpoint the treatments that have been proposed to control craving.

Methodology

This systematic literature review was carried out under criteria of Cochrane Collaboration (Higgins et al., 2022) from a qualitative approach and descriptive level, which facilitates an update of the precise terms that are subject to changes in time. The systematic review of research and scientific articles was supported by platforms such as Google Scholar, and databases such as Scielo, Dialnet, Scopus, PubMed, Web of Science and EBSCOhost. Finally, 100 articles were selected and included in the review.

The following keywords connected by the boolean operators were used for the search: "drug abuse [and/same/with/near/adj] predisposing factors", "craving [and/same/with/near/adj] psychosocial factors", "drugs addiction [and/same/with/near/adj] risk factors", "craving [and/same/with/near/adj] neurobiology of addiction", "craving models [and/same/with/near/adj] craving factors".

Included studies: we took into account only research and articles in Spanish and English, published in scientific journals between 2018 and 2023, which describe results from a quantitative and qualitative perspective. For identify factors associated with craving was selected empirical research in the adult population of all ages. Likewise, in the topic of explanatory models, were included research texts of systematic review and meta-analysis, allowing to locate broader approaches to the topic. Also included research on the phenomenon of craving in all types of chemical and non-chemical addictions.

Excluded studies: excluded research more than 5 years old and studies in children and adolescents and animals.

Procedure: keywords were established for the search engines of the selected databases; from the identification of articles in the databases, it was advanced to the reading of titles and discarding duplicates and those that did not meet inclusion criteria. Then it was performed an exhaustive reading of abstracts and correcting inclusion criteria to provide greater validity and reliability of the search results. Finally, was conducted a reading and analysis of complete texts, completing a checklist in Excel, adapted from the Strobe guide.

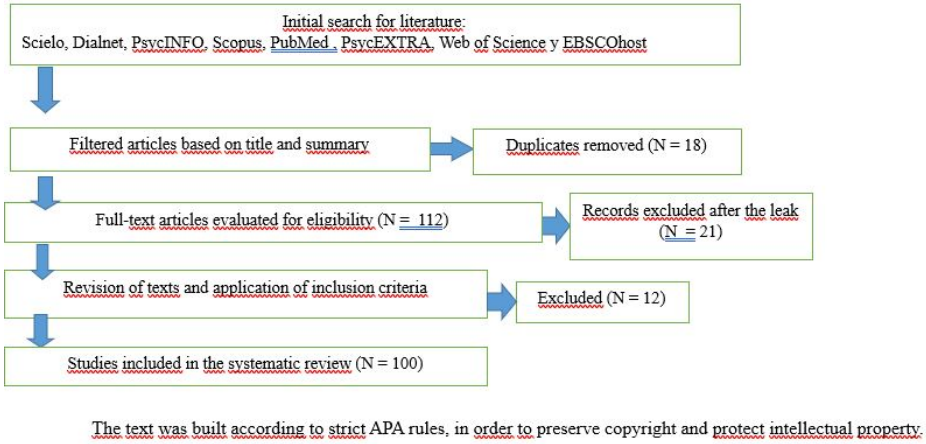

Figure 1
Article selection flowchart

Results

Explanatory models

Craving is a complex and multifaceted phenomenon that has been studied in the fields of psychology and psychiatry. Several explanatory models have been proposed to understand craving in chemical and behavioral addictions. Below are some of the most relevant models.

Neurobiological model

This approach focuses on the neurobiological basis of craving. It is arguing that addictive substances affect brain reward and motivation circuits, leading to changes in brain chemistry that contribute to craving.

First, in relation to the neurobiological bases of the desire to consume or to perform other compulsive behavior, it is important to refer to the reward circuit represented by a functional neural network in mammals, acting as a neurobiochemical and neuroanatomical substrate of pleasure sensation, operating as associated with reward in behavior (Dresp-Langley, 2023).

This reward system is not located in a single brain area but consists of a set of structures located in different areas of the brain and interconnected with each other, being the two most important structures the ventral tegmental area and the *nucleus accumbens*, also participating other areas such as the hypothalamus, the hippocampus, the amygdala, the prefrontal cortex, the ventral pale, and the pituitary gland (Volkow et al., 2019).

On the other hand, animal models of addiction and craving, as well as pharmacological studies in humans, have indicated that various neurochemical systems contribute to neuroadaptation. For example, neurotransmitters of dopamine, glutamate, GABA (gamma-aminobutyric acid) and endogenous opioids, as well as neurons that respond to these molecules, may play a role in the development of reward memory (Pardue, 2023).

Despite the widespread nature of craving and its clinical significance, desire remains poorly understood. Specifically, it is unclear how their phenomenology can vary across the spectrum from “healthy” cravings to those experienced in the context of addictive behaviors. This limited understanding arises from the lack of knowledge about the neural bases of the subjective craving experience (Konova & Schweitzer, 2023).

Kulkarni et al. (2023a; 2023b) state that there is a difference in key predictive regions involving motor, sensory, attention and desire-related areas, which distinguish cannabis users from non-users, being, in addition, these networks strongly related to craving in chronic consumers.

Koban et al., (2023) identified a neural connectivity pattern, which they called the *neurobiological desire signature*, which includes the ventromedial prefrontal and cingulate cortex, ventral striatum, temporal/parietal association areas, the middorsal thalamus and cerebellum. The authors claim that this pattern’s responses to drug versus food signals can discriminate drug users from nonusers with a high degree of accuracy, in addition, its differential modulation by the self-regulation strategy employed by the subject, involving neural circuits related to cognitive control. Likewise, the authors highlight that the craving for drugs and food perhaps shared neurobiological mechanisms.

Garrison et al. (2023) conducted a highly complex study identifying a pattern of neural connectivity in people with craving for substance and food consumption and other compulsive behaviors. The study suggests that the neural signature (connectivity pattern) of craving in people who consume substances shares similarities with other types of cravings, such as the craving of their favorite foods. This corresponding neural network includes the posterior cingulate cortex and the hippocampus, which are part of the canonical network in a predetermined way, primary sensory cortexes, and a subcortical network, being highly distributed and complex, which implies a more detailed analysis to better understand.

Antons et al. (2023) state that craving could be predicted through a model that reflects general neural mechanisms for substance and behavioral addictions, being the prefrontal regions associated with working memory and autobiographical memory which is important in this prediction model and includes complex motor/sensory networks, frontoparietal and by default networks, functionally associated with memory components, valence ratings, physiological responses, and motor imaging/finger movement.

In general, the authors highlight that this neurobiological model has a high predictive accuracy in relation to traditional clinical variables, which indicates that interindividual heterogeneity in brain-based characteristics contributes significantly to the results in addiction and craving phenomenon (Kronberg & Goldstein, 2023; Yip et al., 2020).

Model of Tolerance and Abstinence

The relationship between tolerance, abstinence and craving is fundamental to understanding the cycle of addiction.In this explanatory model, craving is associated with the subjective experience of withdrawal symptoms and the need to consume greater amounts of the substance to obtain the same effect due to the phenomenon of tolerance, which appears when the body adapts to the continuous presence of a substance requiring increasing doses to experience the same effects. When a person who has developed tolerance tries to reduce or stop using the substance, may experience withdrawal symptoms, which may include physical and emotional discomfort, and which may increase the desire to use the substance to relieve those symptoms (Rigoli & Pezzulo, 2023).

Tolerance can also contribute to craving, as the need for higher doses to experience the desired effects can intensify the compulsive desire to consume the substance. The relationship between these elements underlines the complexity of addiction and the importance of addressing the physical and psychological aspects of dependence in treatment programs. Approaches that address tolerance, abstinence and craving may include behavioral therapies, pharmacological therapies, social support and lifestyle changes (Rigoli & Pezzulo, 2023).

Model of the Emotional Regulation

This model suggests that craving is related to the attempt to regulate negative emotions. People may use the substance or addictive behavior to relieve stress, anxiety or other uncomfortable emotions. In this context, craving is experienced as an attempt for emotional self-regulation. Walukevich-Dienst et al. (2023) identified the correlation of craving in cannabis use with greater awareness in the experimentation of negative emotions. It has been identified that craving or desire to eat is associated with negative emotions, such as anxiety, depression, sadness, stress, low satisfaction with life and loneliness, and eating guided by these emotions can contribute to the craving phenomenon related to food addiction (Dicker-Oren et al., 2022; Rodrigues de Oliveira Penaforte et al., 2019; Sze et al., 2021). Schaefer et al. (2023) state that food craving can promote a greater sense of guilt in people with eating disorders, which then predicts an increased risk of binge eating.

On the other hand, craving can also be related to the search for pleasant subjective states related to positive emotions, craving being an emotional state related to the deregulation of positive affect, affecting the appearance and control of behavioral addictions such as gambling (Rivero et al., 2023).

Kamboj et al. (2023) found that craving in alcohol consumption has a positive correlation with the tendency to rumination and with experiential avoidance, related, in turn, with alexithymia, suggesting that therapeutic intervention aimed at increasing adaptive emotional regulation strategies may help reduce craving and alexithymia in alcohol dependence.

It is important to note that craving is associated with the relief of negative emotions and the scope of positives. In this regard, Månsson et al. (2024) indicate that the participants of their study described from subjective perception the alcohol craving as an expected relief of internal negative sensations, such as anxiety or stress, while craving for play was most often described as an expectation of positive emotions related to financial rewards.

Model of Learning and Conditioning

This model is based on the idea that craving is the result of an associative conditioning between stimuli related to addiction and the reward obtained through the consumption of substances or the performance of addictive behaviors. Situations, places or people associated with addiction can act as craving triggers. Ginsburg et al. (2022) indicate that conditioned stimuli associated with alcohol intake play a role in relapse by producing craving which, in turn, increases motivation to drink, which increases the search for substance and alters other ongoing behaviors.

Model of Information Processing

This approach suggests that craving arises from the way people process addiction-related information. Expectations and selective attention to addiction-related stimuli can increase craving intensity (Nickel et al., 2023). The study of perception patterns in players with Internet gaming disorder indicates greater attention and anticipation expectations for stimuli associated with gambling activity (Park et al., 2023).

Brown et al. (2018) have found that the attention of social drinkers is preferably directed towards alcohol-related stimuli (attention capture), which plays an important role in increasing alcohol craving that can result in dangerous consumption.

Månsson et al. (2023) indicate that craving states are associated with mental images related to the process of consumption or addictive behaviors, such as preparation rituals, anticipation and sensory activation and expected outcomes, showing the importance of working with thought content in people with addictive behaviors to prevent and decrease craving.

Model of Needs Satisfaction

This model is based on the idea that craving can be related to the satisfaction of psychological needs, such as the pursuit of pleasure, the feeling of belonging or the feeling of control. Craving represents an attempt to satisfy these needs through addiction.

Tóth-Király et al. (2019) state that the satisfaction of psychological needs such as self-esteem, belonging, social acceptance, among others, acts as a protective factor in relation to obsessive behavior and craving associated with screen-based activities, like using Facebook, watching TV series, online games and games on smartphones, being, on the contrary, the frustration of needs a potential risk factor in the case of craving for screen-based activities.

The study by Tomova et al. (2020) states that the deprivation of food need and social interaction emerges craving associated with these needs, shown selective activation of the mesencephalon to dietary signals after fasting and social signals after social isolation, correlating the above with self-reported desire.

On the other hand, considering sexuality as a necessity, Nayak and Kumar (2023) argue that there is a correlation between sexual satisfaction and pornographic desire among young adult women.

Finally, it should be noted that the models described above are not mutually exclusive and often overlap in the explanation of craving. Full understanding of craving in addictions usually involves a combination of biological, psychological and social factors, and may vary from person to person. Research and therapy focus on applying these models to develop craving prevention and treatment strategies in the context of chemical and behavioral addictions.

Factors associated with craving

There are several factors associated with craving, and these may differ may depending on the type of addiction or the object of desire.

From the neurobiological point of view, craving is often linked to the activation of specific brain circuits, such as the reward system. Addictive substances often affect neurotransmitters such as dopamine, which plays an important role in the experience of pleasure and motivation (Dresp-Langley, 2023; Kakko et al., 2019; Koban et al., 2023; Pardue, 2023; Volkow & Boyle, 2018).

Regarding endogenous factors associated with hormonal states, studies have been identified that relate the phenomenon of menstruation with food craving and negative emotional states, especially in the premenstrual phase, increasing consumption of processed foods in women in this period (Moreno Gómez & Jáuregui-Lobera, 2022).

Psychosocial factors also contribute significantly to the emergence of craving for both: substance use and behavioral addictions.

Studies indicate that factors associated with consumption characteristics and psychological traits of users are important in explaining craving and relapse in substance use. Guo et al. (2022) argue that craving for substance use is positively associated, on the one hand, with the frequency of substance use, drug rehabilitation times, and on the other, with the psychological characteristics of shyness and shame; and is negatively associated with self-esteem.

Gong et al. (2021) found that psychosocial factors such as life events, positive psychological capital, interpersonal trust, psychological security and family intimacy negatively predict substance craving, while aggressive behavior, impulsivity, alexitimia, parental conflict and deviant peers predict it positively.

Sliedrecht et al. (2022) argue that the meaning of life has an important relationship with alcohol consumption by decreasing craving and relapse rates.

On the other hand, self-efficacy understood as the ability to resist the use of substances in situations of risk is related to a lower level of craving in patients with different types of addictions (Abdelmouttelb et al., 2022).

Stress and anxiety are important factors that can increase craving. People often turn to addictive substances or behaviors to deal with these emotions. Anxiety predisposition is an important risk factor for craving in a variety of addictive behaviors such as smoking, alcohol consumption, among others. Salwa et al. (2023) indicate that high anxiety was associated with food cravings, leading to the generation of food addiction. However, it is important to investigate whether anxiety is a predisposing factor or is the result of substance use.

On the other hand, people who have experienced trauma can resort to addictive substances to deal with emotional pain, which can result in craving. Russo et al. (2023) argue that there is a positive association between adverse childhood experiences and intention and prior planning or lack of control of craving behavior.

From the environmental aspects, the signals and stimuli of the environment, such as specific places, people, situations or characteristics of substances, behaviors or objects that are consumed can trigger craving. These stimuli are often associated with past experiences of substance use or addictive behavior. For example, Silverman et al (2023), from a systematic review study, conclude that music has the potential to induce craving of substances such as alcohol, cannabis, nicotine and others, causing both positive and negative emotional states.

For example, in the specific case of addition to food, the sensory characteristics associated with food participate in the regulation of appetite due to the subjective pleasure associated with eating, can lead the person to ingest food compulsively, increasing the desire to consume highly palatable and energy-dense foods. This type of hunger called hedonic is closely related to food craving (Hernández Ruiz de Eguilaz et al., 2018). In turn, this type of hunger and the associated craving is positively related to the female gender, younger age, reduced regular physical activity, consumption of night snacks and weight loss diets. Also, it has been determined that individuals with hedonic craving have a high level of food craving, impulsivity and low self-esteem (Kahraman & Ok, 2022).

Regarding technology addiction, Hämäläinen et al. (2022) argue that the attractive and highly addictive characteristics of content consumed through smartphones can cause three types of craving: to stimulation, sensation and content, encouraging the excessive and compulsive use of these devices, and eventually causing technostress in their users.

Environmental learning also contributes significantly to craving, due to the intensification of dopaminergic effects associated with stimuli related to consumption and addictive behaviors. Previous experiences of pleasure associated with the consumption of a substance or the performance of an addictive behavior can be recorded in memory, which contributes to the desire to repeat that experience (Linnet, 2020; Zack et al., 2020).

Likewise, reward characteristics and positive reinforcements, from the point of view of their frequency and variability, act as positive enhancers for craving. Clark and Zack (2023) argue that, in behavioral addictions, including gambling, shopping, social media and online pornography, among others, qualitative and quantitative reward variability may confer addictive potential to non-pharmacological enhancers by exploiting psychological and neuronal processes that depend on predictability to guide reward-seeking behavior.

Environmental conditions also can be associated with craving through its impact on the production of positive and negative emotional states. For example, Martin et al. (2019) proposes that greater exposure to nature may be associated with lower levels of craving. In his study, access to gardens/plots and residential views that incorporating more than 25 % of green spaces were associated with reductions in the strength and frequency of craving.

Regarding social factors, it is important to note that social influences, such as peer pressure or social acceptance of addictive behaviors, can contribute to craving. Lui et al. (2023) argue that racial discrimination and the negative experiences related to it have an impact on the increase of craving in alcohol consumption.

On the other hand, Tovmasyan et al. (2022) direct attention to the influence of cultural representations associated with the use of alcohol in social situations of all kinds of celebrations and social events. In this sense, the low perception of risk of alcohol consumption and its use accepted and stimulated by advertising can induce craving from social learning that associates the well-being with alcohol consumption in situations of social interactions.

Exposure to social influences through participation in virtual social networks can lead to the development of food cravings and problematic eating behaviors. Filippone et al. (2022) state that longer exposure times to social networks are indirectly related to an irrepressible need to eat, mediated by greater impulsivity.

In closing, it is necessary to point out that understanding the multiple factors associated with craving can be crucial to develop effective strategies for the prevention and treatment of addictions. It is important to note that these factors do not act in isolation and often interact with each other.

Therapeutic approaches for craving management

As for the treatment of craving it is important to note that this can be a personalized process and require the combination of different approaches. Each person is unique and can respond differently to different strategies. In many cases, treatment should also address the underlying causes of addiction, such as stress, depression or other mental health disorders. Therefore, it is essential to seek the help of health professionals, such as therapists, psychiatrists or counselors, to develop an effective treatment plan.

As for the approach to this problem so far, cognitive behavioral therapy (CBT) is a psychotherapeutic approach most used to treat a wide variety of addictions and craving disorders. It helps identify negative thoughts and behaviors that contribute to craving and develop strategies to change them (Hinojosa-Aguayo & González, 2022; Gonzales Sepúlveda, 2018).

In this aspect, there are multiple cognitive-behavioral techniques for craving management, such as physical control strategies, muscle relaxation and deep breathing, stress inoculation and self-directions, training in problem solving, self-control, cognitive restructuring, coping strategies, among others (Megada & Aryani, 2023).

As for traditional approaches, Exposure Therapy and Response Prevention (ERP) is also used. This approach involves exposing the person to situations or stimuli that trigger craving, but without allowing them to consume the substance or perform addictive behavior. The idea is to reduce craving response through controlled exposure.

Contemporary technological advances have allowed the use of virtual reality in this type of therapy, presenting a greater improvement in craving and anxiety reduction in patients suffering from an alcohol consumption disorder, also increasing the sense of self-efficacy and decreasing the tendency to adopt automatic drinking behaviors (Nègre et al., 2023).

Currently there is also the development of different mobile applications that are administered from smartphones and can be used for any addiction (substance or behavior) (Quílez Moya, 2021). This approach is called Momentary Ecological Intervention and consists of a treatment procedure characterized by the delivery of interventions (messages on smartphones) to people in their daily lives, allowing the availability of treatment at times and in situations where it is most needed. For example, the Craving-Manager smartphone app has been designed to diagnose addictive disorders and evaluate and manage craving, as well as individual predictors of use/relapse. It offers specific and individualized interventions (counseling messages) composed of evidence-based treatment approaches for addictions (cognitive behavioral therapy and mindfulness) (Serre et al., 2023).

About the biochemical approach, we can refer to the transcranial continuous current stimulation method that helps treat craving, for example, in cases of overeating, smoking or other addictive disorders, by modulating specific neural pathways (Orrù et al., 2022; Vázquez Beceiro, 2018).

From this approach, in some cases, drugs are used to help reduce craving. For example, in the treatment of alcoholism are used the drugs such as naltrexone, acamprosate, buprenorphine, methadone, topiramate, modafinil and atomoxetine, N-acetylcysteine, among others. Pharmacological treatments mostly allow to increase the concentration of neurotransmitters in the nervous system affecting mood, impulse control, among others. However, it is necessary to have a supervision and control of treatment due to possible adverse effects (Arreaga Régil & Campos Flores, 2021; Cunill et al., 2021; Marin David et al., 2023; Murillo-García & Berrouet-Mejía, 2022).

In the same line of biochemical approaches can be related the approach of psychedelic therapies, which, being initiated in the middle of the twentieth century, has had a resurgence of interest by the scientific and medical communities in the last decade, due to the accumulation of evidence of its safety and efficacy in the treatment of a variety of psychiatric disorders, including addiction (Zafar et al., 2023).

In this respect a growing body of evidence indicates the presence of positive and significant therapeutic effects of psychedelics in the treatment of addiction (both chemical and behavioral), including "classical psychedelics": lysergic acid diethylamide (LSD), psilocybin, dimethyltryptamine (DMT), ayahuasca (drink containing DMT and a monoamine oxidase inhibitor that prevents degradation in the intestine), 5-methoxy-N,N-dimethyltryptamine (5-MeO-DMT, mescaline (cactus peyote), all of which act as serotonin receptor 2A (5-HT 2A R) agonists. In addition, there are "non-classical psychedelics" such as ketamine, 3,4-methylenedioxymethamphetamine (MDMA) and ibogaine (from the Iboga plant). The last decade has seen an expansion in understanding the mechanism of action of these compounds, using modern biomedical techniques ranging from preclinical molecular biology to human neuroimaging in real time (McNulty, 2021; Rucker et al., 2018; Zafar et al., 2023).

Another approach to craving is based on the philosophy of healthy life and mental hygiene, employing mindfulness techniques and meditation that can help people recognize their desires and learn to observe them behavior.

Mindfulness seeks to promote a state of introspection that offers the opportunity to effectively address craving, avoiding automatic responses and relapses. Studies indicate multiple benefits of mindfulness when re-structuring cognitive and behavioral responses to craving symptoms (Casas Gavilán & Peña Llorente, 2018; Demina et al., 2023; Tapper, 2018). Similarly, maintaining a healthy lifestyle through regular exercise and a balanced diet can help reduce craving by improving overall well-being and reducing stress (Mahindru et al., 2023).

On the other hand, Pasqualitto et al. (2023) argue that music therapy and music-based interventions can reduce anxiety symptoms in people with substance use disorders, because the autobiographical memories evoked by music and craving share similar neural activations with perineuronal networks that represent a causal element in the memory processing of addiction; music can also evoke memories associated with drug personal history and the corresponding strong emotions (memories of addiction). In this aspect, music can help update and/or recalibrate, within therapy, the emotional content related to memory considering the neuroplastic characteristics of memory.

Finally, it is important to mention family support and support networks as a factor of great relevance in addressing the problem of craving. Having the support of friends and family, as well as a support group of people who share similar experiences, can be critical in craving treatment. Group therapy provides social support and an environment in which people can share their experiences and strategies to deal with craving (Bourdon et al., 2023; Heydari Fard et al., 2019; Muswerakuenda et al., 2023).

Discussion and conclusions

As can be seen from the analysis of the available literature, craving represents a rather complex phenomenon that has been considered a central characteristic of addiction and a predictor of relapse (Cless et al., 2023).

In this way it is important to consider the role of craving as a marker of addiction, being this a central element in the network of symptoms associated with the addictive disorder, regardless of the substance or behavior. This is an important avenue for understanding the mechanisms of addiction, with implications for improving diagnostic validity and clarifying treatment goals (Gauld et al., 2023).

The desire to use drugs also acts as an important predictor of emotional manipulation ability, effective interventions are needed to encourage people with an addictive disorder to self-reflect on how their craving for drugs can lead them to prioritize their needs over others (Khedr et al., 2023).

Being craving a very complex phenomenon, its foundation cannot be based only on the neurobiological explanation. To understand this phenomenon, it is necessary to recognize that psychosocial factors affect vulnerability to addiction, including the cultural, cognitive and phenomenological point of view, and sensibility to emotional and psychological needs and values (Ahmadi Roghabadi et al., 2023; López-Guerrero et al., 2023; Månsson et al. 2023; Nickel et al., 2023; Russo et al., 2023; Silverman et al., 2023.

Considering the high complexity of craving, it is evident the importance of an interdisciplinary approach, oriented to foster personological resources of coping as self-efficacy, resilience, existential autonomy, self-consciousness, self-control and self-esteem, practice a healthy lifestyle, orientation towards self-realization and transcendence in life, and life skills (Abdelmouttelb et al., 2023; Demina et al., 2023; Henden, 2023; Kalinin & Edguer, 2023; Zhang et al., 2020).

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