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Does impulsivity increase the risk of developing a pathological condition?

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Summary

Background: With the term addiction, the scientific community refers to a psychopathological category related to a rather variable series of addictions to different substances and behaviors, among which we can find common generic elements. The most important part in the definition of addiction is represented by the continuous research for gratification. The psychopathological manifestation of the disease consists of three key symptoms: craving, relapse and loss of control (impulsivity). Discovering and studying a factor of vulnerability in the development towards this psychopathology would certainly represent a goal and would have both predictive and explanatory importance. **Methods:** This short review is an attempt to explore impulsivity concept and its relations with addiction, in particular cocaine addiction. **Results:** In literature, there are numerous studies that indicate the excessive amount of impulsivity and the non tendency to control impulses as pre-existing factors and possible predictors of vulnerability for the development of an addiction. Furthermore, some neurocognitive studies have shown how cocaine-addicted subjects show more impulsivity towards both movements (impulsive action) and, cognitively, in the decision-making capacity (impulsive choice). **Conclusions:** It is rather common to find higher impulsivity traits in gamblers than in the general population; therefore, this trait could represent an important risk factor and predisposition to the development of a clinical picture of dependence.

Key Words: addiction; impulsivity; craving; cocaine; relapse; misuse

1. Introduction

Defining pathological dependence (addiction) is not easy because it is known to be the result of complex neurobiological, psychophysiological and social interactions; in fact, several scientific disciplines are involved, both in the diagnostic and in the therapeutic process [14]. Furthermore, as some recent works have pointed out, the debate on the nature of addiction and its etiopathogenesis risks misleading the scientific community, which should be interested in expanding knowledge on the subject and recognizing the destructive nature of addiction and substance abuse [18]. Pathological addiction is characterized by the irregular use of a substance, an object or by the

abnormal repetition of a behavior: it features an ir-repressible impulse and uncontrollable need to use a substance in an exaggerated way. This type of behavior must cause clinically significant discomfort to be considered pathological [9]. In the latest edition of the DSM-5 [2], the categories of substance abuse and dependence were incorporated into a unique category called "substance use disorder", measurable on a mild to severe continuum; in this new category, diagnosis criteria were combined into a single list consisting of 11 symptoms, with the insertion of "craving" [3]. Gratification, linked to the use of the substance, determines a positive reinforcement that unleashes the vicious circle of dependence, tolerance and abstinence, thus considered pathological [9].

The development of an addiction usually occurs in the presence of convergent and various elements such as environmental, social, neurobiological and hereditary genetic factors [26]. All these factors would appear to contribute, more or less, to the determination of a phenotype with a susceptibility for substance use (or behavior repetition) and the development of addiction. As already known, in all addiction types we can observe that, soon after the removal of the object in question, a strong increased desire for rapprochement will manifest; in the absence of reconciliation, symptoms of abstinence may emerge [20]. The main core of the disease consists in a continuous search for gratification provided by contact with the object in question; this research is constantly repeated, creating dysfunctional habits and rarely a balanced behavior [4]. The main purpose of the subject with pathological addiction focuses on obtaining the object itself and the individual tends to follow an appetitive drive that obscures everything else [27]. Other elements that may be useful in identifying and recognizing pathological dependence are: 1) the development of fixed patterns of behavior that bring positive reinforcement and are pleasant for those who indulge in them; 2) the presence of physiological and psychological components closely linked to the development of addiction; 3) the complexity of the patient's interruption of behavior due to the interaction of these factors [14].

Beyond these factors, others constituting the behavior of pathological dependence may include craving, relapses and control loss (impulsivity). Craving can be defined as a strong motivational state that leads to researching and using substances or behaviors accompanied by negative feelings of quenchless desire [21]. Craving is a mechanism based on a neurobiological aspect, since substances of abuse act chemically on the same neural circuits and neurotransmitters of pleasure, implicated in the physiological and most basic human needs such as hunger, thirst or sexual desire [39]. This behavior has cognitive elements in common with behavioral addictions and substances: it seems to play the role of a common denominator in the different expressions of pathological addictions, tending to be activated in the presence of environmental stimuli that recall the encounter with the object, but also in response to stressful events or to particular emotionally significant situations [9, 25]. Craving can also occur in the absence of the object of addiction and can be associated with intense physical reactions, arousal, tension, tachycardia, sensations of heat and nervousness [46, 6]. Furthermore, the rela-

tionship between craving and the use of substances is of great interest because it represents a target of many psychotherapies and is therefore modifiable in interventions for relapse prevention [47].

The second key aspect of addiction is relapse, defined as the loss of control over the use of the substance or the behavior perceived by the subject. Two factors have been shown to be very important for relapses: social support and having convincing ideas of self-efficacy. In this regard, a recent study observed how high levels in these two aspects can effectively prevent relapse in the field of addiction [33]. The third key element, which we will discuss in depth in the next paragraph, is impulsivity, the involvement of which appears fundamental in the urge to gratify oneself through use of chemical substances [35]. The subjects suffering from addiction show a reduction in inhibition control for substance use and an increased impulsivity that involves a compulsive and harmful use of the substance, despite evidence of the negative consequences. It is unclear whether the increased impulsivity and an altered ability to make decisions are induced by the substance, pre-existing factors of vulnerability or a combination of them [16].

2. Methods

This short review is an attempt to explore impulsivity concept and its relations with addiction, in particular cocaine addiction. We identified PubMed as database for our research and selected addiction, cocaine, relapse, misuse, impulsivity, craving as specific keywords.

3. Results

3.1. Addiction and impulsivity

In recent literature there are several citations that consider impulsivity and the control of the impulses as pre-existing markers of vulnerability to a state of dependency [44, 4, 1]. Understanding the association between overdosing and impulsivity can be useful to control possible implications [12, 32]. Impulsivity is a multidimensional construct defined as the tendency to take rapid decisions and acting without taking into account possible consequences [40] or as the trend to act with less caution than individuals with equal skills and knowledge [13, 28]. The difficulty in delaying gratification by acting impulsively has been observed and studied, for example, in drug addiction [7]. Impulsivity comprehends two aspects: impulsiv-

ity in action (impulsive action) and the inability to plan and make decisions while evaluating the consequences in the immediate moment and the future [5]. We must also distinguish impulsivity in decision-making, which is often the result of a distorted evaluation of the long-term consequences, and the impulsivity of reflection, which refers to the tendency of not taking into account sufficient information for making decisions [11].

Observing addiction, we can distinguish four personality characteristics associated with different dimensions of impulsive behavior: in the first place, the lack of planning or the tendency to act without adequate previous reflection, secondly the feeling of urgency to act under an impulsive drive in order to ignore the emotional experience, thirdly the tendency to seek adventure and excitement (sensation-seeking), and, finally, the difficulty in focusing on a given task and in tolerating frustration [22].

Impulsivity turns out to be a factor that actively contributes to abusing behavior: in fact, impulsive traits are associated with gambling and other addictive behaviors [29, 36]. Impulsivity, or else the tendency to make quick decisions, has been demonstrated to include a deficit in planning and a lack of reflection and self-control in relation to alcohol addiction [41]; furthermore, both impulsivity and lack of planning are significant predictors of alcohol abuse [8]. Traits mostly associated with addictions resulted to be impetuosity and lack of perseverance [34].

3.2. *The role of impulsivity in cocaine addiction*

Cocaine addiction is an increasingly widespread disorder in the general population; it is estimated that in the United States, in 2014, more than 700,000 patients received therapy to counteract cocaine abuse [37]. Furthermore, it appeared to be the most used stimulating substance in Europe and the United States [48]. The scientific literature questions the potential risk factors predisposing the development of an addiction and has highlighted pre-existing psychiatric disorders as one of those factors; more precisely anxiety disorders, mood disorders, personality disorders, positive family history of substance use, early age of use and male gender emerged as risk factors [15, 38]. In addition, scientific research is increasingly observing and defining the construct of impulsivity, that could represent a predisposing factor to the development of a severe clinical state, consequence of an addiction, and the psychopathological mechanisms involved or a neurotoxic effect induced by the

substance itself.

As anticipated, impulsivity is generally considered a salient feature of substance use disorders, particularly in cocaine addiction [31]. From the literature it emerges that the subjects using cocaine have a deficit in controlling actions and a greater tendency to make impulsive choices than the general population [17]. Also an association between impulsive traits and cocaine dependency behaviors and other drugs in adolescents emerged: in particular the subjects who showed a marked impulsivity performed a greater number of typical substance-dependent behaviors compared to subjects with low impulsivity [10]. In general, results indicate that cocaine addicted subjects were more impulsive than a control group composed of healthy subjects, in particular with regard to trait impulsivity and motor inhibition capacity; they appeared also to be less reflective, using less information to make a decision. The same study by Stevens and colleagues found that only those who had cocaine abuse in comorbidity with ADHD were significantly more intolerant of delayed gratification than healthy controls, preferring immediate gratification of their needs and thus implementing more impulsive choices. This result suggests that using cocaine concomitantly with ADHD leads to an even more severe psychopathological outcome [42]. Patients with substance addiction in comorbidity with ADHD would appear to show a higher level of impulsivity which could explain the greater incidence of ineffective treatments and the greater probability of relapse [45]. Besides being a risk factor in the development of an addiction, impulsivity also appears to be a significant predictor of dropouts in the treatment of cocaine addicts: this suggests the application of targeted intervention both to treatment of addiction and to reduction of impulsivity itself in subjects with this disorder [42, 43]. At the same time, however, impulsivity is related to the quantity of ingested substance: as the use of cocaine increases, impulsive behaviors also increase. From this it appears that the decrease in impulsive behavior can be an indicator of the effectiveness of treatment aimed at reducing dependence on the substance itself [24]. Furthermore, it is not possible to establish with certainty whether the measured higher levels of behavioral impulsivity and decision making are a consequence of cocaine use/abuse, a factor of vulnerability prior to it, or more likely a combination of both [16].

4. Discussion

An increasing number of studies have highlighted the importance of the role of impulsivity in substance use disorders, in particular in cocaine addiction, and their impact on social and working functioning of people [10].

Impulsivity turns out to be a complex and varied construct and, for this reason, difficult to evaluate adequately, especially in subjects who abuse substances, because of the neurotoxic effects that substances have on the brain, influencing the impulsive behavior itself. Impulsivity in cocaine-addicted subjects would seem to play a role in determining the severity of the symptomatology. Understanding the role and contribution of impulsivity, planning deficit and in delaying gratification can be useful in establishing more appropriate and effective intervention in the treatment of addictions. Moreover, these evidences suggest the usefulness of an integrated treatment aimed at reducing impulsivity in subjects with addictive problems [43].

One of the limits of research in this area is certainly the impossibility to define the exact temporal order of symptomatology onset: in fact it is difficult to evaluate the level of impulsivity preceding the beginning of the disorder.

5. Conclusions

Early identification of subjects with high levels of impulsivity may be useful in order to optimize some clinical aspects such as the personalization of prevention and the development of appropriate interventions.

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