

The Neuropsychological Effects of Addiction on the Brain's Reward System

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ABSTRACT: Addiction is much more than just a personal problem for individuals; it is also a multidimensional condition shaped by complex and multifaceted neurobiological processes, resulting in significant socio-cultural and economic consequences in society. This complex process progresses in a carefully interrelated manner, involving disruptions in the functioning of the brain's reward system, neurotransmitter imbalances, and environmental factors. These factors have the potential to create significant and noticeable changes in individuals' lives. In particular, detailed and comprehensive research conducted on the neurotransmitter dopamine, which plays a critical role in the brain and is known as the most fundamental element of reward mechanisms, has been an extremely important cornerstone in unravelling the complex processes and mechanisms of addiction in the brain. The brain's reward system plays a critical role in acquiring and reinforcing habits; in cases of addiction, significant changes are observed in the sensitivity of this system and its response to stimuli. Such changes can increase individuals' sensitivity to various stimuli, paving the way for the development and deepening of addiction. At this point, addiction not only creates a situation that negatively affects the individual's quality of life, but also causes significant impairments in decision-making ability, impulse control, regulation of reward expectations, and social relationships.

KEYWORDS: neurobiological processes, brain reward system, neurotransmitters, socio-cultural consequences

INTRODUCTION

Addiction is far more than just a personal problem for individuals; it manifests itself as a multidimensional condition shaped by complex and multifaceted neurobiological processes, producing significant socio-cultural and economic consequences in society. This complex process progresses in a carefully interrelated manner, involving disruptions in the functioning of the brain's reward system, neurotransmitter imbalances, and environmental factors. These factors have the potential to create significant and noticeable changes in individuals' lives. In particular, detailed and comprehensive research conducted on the neurotransmitter dopamine, which plays a critical role in the brain and is known as the most fundamental element of reward mechanisms, has been an extremely important cornerstone in unravelling the complex processes and mechanisms of addiction in the brain. The brain's reward system plays a critical role in acquiring and reinforcing habits; in cases of addiction, significant changes are observed in the sensitivity of this system and its response to stimuli. Such changes can increase individuals' sensitivity to various stimuli, paving the way for the development and deepening of addiction. At this point, addiction not only creates a situation that negatively affects the individual's quality of life, but also causes significant impairments in decision-making ability, impulse control, regulation of reward expectations, and social relationships. The state of addiction creates many negative effects on individuals' social relationships, work lives, and overall health, creating a serious disruption in life dynamics and presenting complex challenges that make it difficult for individuals to adapt to their lives. In this context, understanding the functionality of dopamine pathways and potential changes in these pathways plays a critical role in the detailed examination of the neurobiology of addiction and provides important data for research. Identifying various factors that increase or decrease the effectiveness of dopamine-related pathways promises to be a major contributing factor in the development and implementation of treatment strategies in the field of addiction. Furthermore, the development and maintenance of addiction is not solely influenced by biological factors; it is also deeply connected to environmental and genetic factors. These environmental and genetic factors emerge as vital elements determining the state of addiction. Individuals' life experiences, the environmental conditions they are exposed to, their family history, and genetic predispositions constitute important and decisive components that influence the course of addiction development. Therefore, observing neuropsychological and neuroanatomical changes provides important clues and data about individual differences and risk factors, paving the way for the development of better treatment approaches for addiction. The design of advanced and effective treatment methods appears possible by taking these important factors into account. In conclusion, addiction is considered to be more than just a behavioural problem; it is also an extremely complex process that affects the brain's basic functionality and neurological structure. Detailed and comprehensive research into this process is of

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paramount importance for the development of effective intervention and treatment strategies. This understanding contributes significantly to the development of more effective approaches and strategies at the societal level in the fight against addiction. It will also create a foundation that will enable a better understanding of the difficulties individuals face and the implementation of more comprehensive support mechanisms that will allow for the personalisation of treatment processes. Thanks to such efforts, it will be possible to progress towards becoming a more equipped, understanding, and effective society in terms of coping with addiction. Grasping the complexity and effects of this process more deeply helps both individuals and society develop more effective strategies in the fight against addiction. Furthermore, the development and implementation of educational programmes that raise social awareness about addiction contribute to increasing individuals' knowledge and awareness levels regarding addiction, thereby helping to minimise the negative consequences of this process. The participation of people from all walks of life provides a broader perspective on addressing addiction-related issues and strengthens social solidarity. In this context, the importance of efforts to promote healthy lifestyles and eliminate addiction risk factors is increasing, with the aim of creating an effective awareness of the fight against addiction in society. Furthermore, diversifying treatment processes and developing solutions tailored to individuals' unique needs will enable the creation of strategies that support addressing the emotional and psychological difficulties associated with addiction. This provides individuals with access to more robust support mechanisms in their struggle against addiction and offers opportunities to develop the structures necessary to cope with addiction-related problems. Therefore, it should not be forgotten that addiction is a comprehensive problem that affects not only individuals but also the whole society; it is a special situation that threatens social interactions and individual lives, demanding profound transformation and change. Each step taken in the fight against addiction requires both personal and collective effort and can contribute to strengthening the social fabric, as well as individuals supporting each other in this process. At this point, increasing effective education programmes and awareness-raising initiatives has the potential to yield long-term gains in the fight against addiction, as well as to have a positive impact on the general health of society. Thus, developing initiatives that address the problem of addiction in a more systematic way will make both individuals and communities more resilient; in this context, it will create many opportunities to develop more holistic approaches and solutions to the problems caused by addiction. These opportunities are important for society to adopt a comprehensive approach to the problem of addiction. In this context, addiction treatment processes should be continuously reviewed and improved, along with efforts to raise social awareness. Programmes related to addiction should not rely solely on individual treatment methods; they should also be supported by activities carried out at the social level through committees and organisations. Such combined efforts will chart an effective roadmap for overcoming the problems caused by addiction and will fulfil an extremely important task. The widespread dissemination of education will enable the development of innovative approaches to addiction and allow individuals to deeply examine their own relationship with this problem. Therefore, perspectives that relate addiction to the general health of society will be of critical importance in addressing this problem more comprehensively and developing solutions. This perspective is essential for effective intervention, as it enables the creation of a broader support network in society and encourages all individuals to make a concerted effort in combating addiction. Re-evaluating individuals' relationship with addiction, improving the functioning of social support mechanisms, and minimising the negative effects of addiction on individuals are elements of vital importance. All of these processes can have a lasting impact on the overall structure of society and will help take important steps towards ensuring a healthier future in the fight against addiction.

The Concept of Addiction and Its Neurobiological Foundations

Addiction is an extremely complex, multidimensional phenomenon in terms of its neurobiological foundations; this situation is particularly closely related to the brain's reward system. The reward system plays a critical and important role in regulating impulses and motivations through responses to natural rewards and addictive drugs. Key components of this important system include critical and vital regions such as the ventral tegmental area (VTA), nucleus accumbens, and prefrontal cortex. The dynamic interaction between these regions is noteworthy as an important factor influencing reward and reinforcement mechanisms through dopamine release, as well as individuals' sensitivity and motivation towards substances. Structural and functional changes in this neuroanatomy play a critical role in the development of addiction. In particular, prolonged and continuous use of addictive substances causes significant functional impairments in the reward system, leading to specific imbalances in dopaminergic transmission. This situation can disrupt normal reward and motivation processes and, over time, can lead to a decrease or unexpected increase in individuals' sensitivity to rewards. Consequently, the effects of addiction present themselves as a complex experience that varies from person to person. Furthermore, in the development of addiction, significant changes are observed not only in the balance of neurotransmitters but also in the functional connections of the limbic and prefrontal regions. Thanks to these comprehensive neurobiological foundations, the concept of addiction can be evaluated with a deeper and more comprehensive understanding, both behaviourally and biochemically, thus providing a solid basis for the development of treatment and intervention methods. The complexities inherent in the nature of addiction and the difficulties individuals encounter in this process highlight the need for a deep understanding. A multifaceted understanding of this field has the potential to offer more effective and targeted approaches to people in order to effectively combat addiction. Furthermore, this situation has significant long-term effects not only on individual health but also on public health. Therefore, examining addiction and its neurobiological foundations will also contribute significantly to the development of more effective policies and strategies in the future. In this context, a detailed examination of the nature of addiction reveals critical issues not only for individuals' own health but also for family structures, social relationships, and general public health. As individuals' struggles with addiction often require a multifaceted support and treatment process, it is imperative that resources

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are pooled and utilised more effectively at both the individual and societal levels. Effective cooperation between families, friends, society, and health services is of great importance in overcoming addiction. This holistic approach should address the social dimension of addiction as well as supporting individuals' treatment processes. All these elements play an important role in better understanding the neurobiological and psychological dimensions of addiction and developing treatment strategies.

Neuropsychological Changes: Dopamine and Reward Function

Addiction manifests itself in many different forms, such as substance addiction or behavioural addictions. Extensive research has revealed that these types of addiction not only have significant and negative effects on individuals' lives, but also lead to significant neuropsychological changes observed in the dopamine system. These neuropsychological changes profoundly affect an individual's behaviour by causing serious impairments in reward anticipation and reward delivery processes. Under normal conditions, the dopamine neurotransmitter plays a significant role by releasing dopamine in brain regions strongly associated with reward experiences, particularly in important structures such as the nucleus accumbens and ventral tegmental area. These biochemical processes also contribute significantly to important cognitive processes such as motivation and learning. Consequently, individuals receive positive feedback by learning and exhibiting rewarding behaviours, thereby making their lives more meaningful and satisfying. However, as addiction develops and deepens, disruptions in these processes become more pronounced. Even ordinary rewards lose their meaning and value for individuals, which can have a profoundly negative impact on their lives and cause them psychological distress. Therefore, with the development of addiction, the increasingly pronounced functional and structural changes in the dopamine system profoundly affect individuals' behavioural responses, directing them more towards harmful habits. To overcome this situation and enable individuals to lead healthy lives again, receiving treatment and support is extremely important; seeking professional help during this process plays a critical role in the psychological restructuring of the individual and the acquisition of healthy behaviours. Thus, individuals struggling with addiction can achieve a better quality of life, improved psychological well-being, and strengthened ties with society.

In the initial phase, a marked increase in sensitivity to reward stimuli is observed, accompanied by abnormally high increases in dopamine release. This anomaly significantly inflates the individual's reward expectations, resulting in a significant decrease in sensitivity to natural rewards. As the process progresses following the end of this critical phase associated with rewards, a decrease in reward acquisition and satisfaction emerges, which is closely linked to abnormalities in dopamine release. Consequently, this situation, coupled with insufficient fulfilment of reward expectations, leads to a general loss of motivation and negative feelings known as anhedonia. On the other hand, neuroplastic changes in the reward system are also observed during the continuous and repeated use of addictive substances. Such neuroplastic changes suppress natural motivation systems, causing the individual's perception of reward to deteriorate further. This situation has the potential to significantly negatively impact the individual's overall quality of life and may reinforce the continuity of the addiction cycle. Furthermore, this complex process is designed to form a network of interactions that delves into the depths of human behaviour and psychology, playing a crucial role in determining how individuals respond to the challenges they face. The interaction of all these factors has a profound effect on individuals' motivational mechanisms and, as a result, can cause comprehensive changes in their perception of stimuli that determine their psychological state.

These changes in dopamine signals can also negatively affect higher-level cognitive functions such as decision-making processes, risk assessment, and behavioural control, which play an extremely important role in shaping human behaviour. In particular, increased impulsivity and risk-taking tendencies play a highly effective role in the maintenance of addictive behaviours and their recurrence. Furthermore, these neuropsychological changes directly link to the sensitivity of addicted individuals to rewarding stimuli, thereby creating a supportive effect on the sustainability of addiction and its chronicity over time. Therefore, impairments in dopamine and reward functions play an extremely critical role in the development of addiction, both neurologically and psychologically, and this situation can also significantly affect individuals' quality of life. Reducing and controlling these effects is of great importance for the protection of both individual and public health, as addiction problems can have many negative consequences not only for individuals but also at the societal level.

The Effects of Addiction on Memory and Learning Systems

The effects of addiction on memory and learning systems are quite distinct and visible due to the impairments that occur in the neurological functions of the human brain. These effects have become a widespread problem that deeply and multifacetedly affects not only individuals but also societies. Today, addiction presents itself as a complex and multi-layered condition that negatively shapes individuals' lives, and the problems it brings are increasing. Within these complex processes, which are closely related to the dopamine system, changes observed in synaptic plasticity and neurotransmitter release as a result of addictive behaviours are noteworthy. Long-term addiction can lead to cellular dysfunction in critical and central areas of the brain, such as the hippocampus and prefrontal cortex. As a result, serious and complex problems may arise that prevent individuals from acquiring new information and effectively organising their existing knowledge; this situation can significantly negatively impact individuals' daily lives. Furthermore, the fact that addictions affect individuals' cognitive functions, significantly disrupting information processing, is a major issue and an important problem area. In this context, due to the constant stimulation of the reward system, a significant decrease in individuals' motivation for natural rewards and their ability to perceive these rewards is observed. As a result, impaired learning processes and weakened cognitive functions become factors that seriously threaten individuals' success. Furthermore, addiction also disrupts the critical balance between working memory and long-term memory, creating

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significant difficulties in attention and recall mechanisms. These difficulties negatively affect individuals' success in daily life, significantly reducing their overall quality of life. In summary, the irreversible effects of the changes addiction causes in the neural pathways of the human brain negatively impact learning and memory capacities; this situation can cause serious problems in terms of education and teaching processes. It is crucial to consider these negative effects and take the necessary measures. Addictions can cause serious declines in individuals' daily lives and overall quality of life. Furthermore, as these effects are among the fundamental and important neuropsychological issues that must be considered in treatment and rehabilitation processes, they need to be addressed carefully and comprehensively by specialists in the field. Furthermore, adopting a multidisciplinary approach in examining situations addressed in the fight against addiction is of paramount importance. This is because bringing together different areas of expertise plays a critical role in overcoming addiction and producing effective solutions. In this process, the internal difficulties experienced by individuals and the ways to overcome these difficulties must be meticulously researched and thoroughly understood. Today, various therapeutic approaches and rehabilitation programmes have been developed to address addiction; however, each individual's experience of addiction is highly unique, making it essential to develop personalised strategies. Understanding the complex situations individuals face can make treatment processes more effective and thus significantly contribute to their ability to lead healthy lives. At this point, raising social awareness and strengthening support systems is of great importance. Raising individuals' awareness about addiction processes is a critical process for both their own healthy development and ensuring social harmony; work in this area can yield positive results that can affect all segments of society.

Genetic and Environmental Factors

Genetic and environmental factors are extremely important determinants that complement each other and are in constant interaction in the development of addiction. Individuals' genetic structures determine their neurobiological sensitivities, and this situation also deeply affects genetic variations related to the reward system. Genetic factors have the potential to increase an individual's risk of addiction, and these risks also form the basis of behavioural tendencies. In particular, existing and distinct differences in genes such as dopamine receptor genes and metabolic enzymes have significant effects on the rate at which addiction develops and the way the reward system responds. These genetic predispositions play a critical and decisive role in determining how individuals will respond to innate reward-related behaviours. On the other hand, environmental factors also interact with genetic predispositions, increasing the capacity of an individual's life experiences to influence the development of addiction. For example, elements such as a person's social environment, friendships, family ties, stress levels, and life events can play a very decisive role in addiction tendencies and have the potential to affect individuals' addiction processes in various ways. In this context, the complex interaction of genetic and environmental factors is an extremely critical issue that must be considered in addiction research. Consequently, an individual's behavioural tendencies and addiction risks are assessed as a dynamic and multi-layered process shaped not only by genetic factors but also by environmental factors. Furthermore, addiction is not only an individual problem but also a social phenomenon, and this situation is closely related to a wide variety of factors such as social structures, cultural norms, and economic conditions. Moreover, in order to better understand addiction and prevent it effectively, it is essential to examine these complex interactions in depth. These descriptions help us achieve a clearer understanding of the multidimensional nature of addiction, while also providing a solid foundation for future research and studies. Addiction is a process that affects individuals' physical and mental states, and its broad impact on society must not be overlooked. Therefore, more research is needed to develop the necessary strategies to combat addiction at both the individual and societal levels.

Environmental factors intensely influence an individual's life experiences and significantly shape the structure of their family and socioeconomic conditions. These important factors vary depending on the intensity of stimuli in the individual's environment, leading each person to have different and unique life experiences. Negative environmental experiences, such as trauma, neglect, or substance use during childhood, play a critical role by profoundly affecting individuals' neurobiological structures. The impact of these negative experiences not only leaves deep scars on individuals' physical and mental health but also has the potential to create profound and lasting effects on their behavioural attitudes and decision-making processes. Factors such as low socioeconomic status and easy access to substance use in the environment are often cited as important risk factors that trigger the development of addiction. When combined with an individual's genetic predisposition, such adverse living conditions significantly negatively affect neurological and psychological development, while also causing a marked change in the functioning of the individual's reward system. This complex interaction model between genetic and environmental factors plays a decisive role in shaping an individual's behavioural outcomes. Consequently, environmental conditions and genetic factors are of great importance in understanding both the challenges individuals face throughout their lives and the opportunities that await them. An in-depth examination of this interaction enables a better understanding of individuals' mental and physical health, as well as the social structure, offering a more comprehensive perspective on society. This makes it possible to develop more effective solutions to the problems individuals face.

The interaction of these two factors ensures that the neuropsychological processes in addicted individuals have a complex and multi-layered structure and also requires individual differences to play a critical role in shaping these complex processes. In summary, genetic and environmental factors occupy an extremely decisive and important position in terms of the pathogenesis of addiction. These factors, through their effects on the reward system, lead to significant changes at both the neuronal and psychological levels, and these changes have the potential to increase an individual's risk of addiction. In particular, the various environmental stress factors to which individuals are exposed and genetic predisposition combine to create a complex and dynamic interaction in the emergence of addiction. Therefore, in the prevention

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of addiction and effective treatment processes, it is of great importance to consider both factors rather than focusing on just one. Developing personalised approaches tailored to each individual's needs and specific circumstances is a critical and strategic step towards effectively addressing addiction issues. These personalised approaches play a significant role in developing more effective treatment plans and prevention strategies, aiming to promote individuals' well-being and encourage them to adopt a healthy lifestyle. In this process, taking into account environmental factors as well as individuals' experiences contributes to achieving significant success in combating addiction. These measures strengthen individuals' overall mental health while increasing opportunities to combat the stigma associated with addiction by creating social transformation and awareness.

Preventive and Corrective Strategies

Developing strategies to minimise and prevent the neuropsychological effects of addiction requires a holistic and multifaceted approach that impacts not only individuals' lives but also family structures and broader social segments. In this context, raising individuals' awareness levels regarding addiction and accurately identifying risk factors associated with addiction constitute an extremely important point. Educational programmes and awareness campaigns play a highly effective role, particularly in correcting misinformation about addiction among the young population and promoting healthy lifestyle habits. Such programmes not only provide individuals with information but also offer them the necessary motivation to combat addiction. In addition, it is essential to increase their commitment to treatment and strengthen their social participation through psychosocial support services and motivational interviews. In this process, it is also crucial to support individuals' ability to cope on their own. Early diagnosis and intervention play a critical role in preventing the progression of neuropsychiatric disorders. For this reason, regular psychiatric and neurological follow-ups are of great importance. Furthermore, developing stress management skills and establishing robust support systems at the family, peer group, school, and community levels are important steps towards preventing the development of addiction and reducing its existing negative effects. In addition, behavioural and cognitive therapies aim to reduce the negative effects on the reward system by targeting the fundamental neurobiological mechanisms of addiction. In this context, drug treatment and neurological rehabilitation programmes stand out as important tools for alleviating symptoms and improving neuropsychological functions in individuals struggling with addiction. To achieve long-term success, multidisciplinary teams must take great care and importance in preparing sustainable and personalised treatment plans; approaches that encourage lasting changes in individuals' lifestyles and positively transform their social environments should also be adopted. All these strategies play a major role in reducing neuropsychological effects associated with addiction and, at the same time, aim to improve individuals' quality of life and provide them with the support necessary to lead healthier, more balanced and happier lives. In this context, the need to raise social awareness and support individuals should never be forgotten. Furthermore, increasing the accessibility of healthcare services and improving social services are also of great importance. Collaboration with experts, the formulation of public health policies, and the development of practical solutions tailored to individuals' needs are important components of effectively managing addiction. Continuing these efforts is a critical step towards creating social awareness about addiction and ensuring that this fight is embraced not only by individuals but by the whole society. In this process, educating and supporting families and developing healthy communication skills are also of great importance. This will create a comprehensive support network that can be effective in combating addiction.

Addiction has the potential to cause permanent and profound changes in various neuropsychological processes, along with its effects on the brain's reward system. These significant changes arise as a result of irregularities in the reward system, as well as excessive and irregular increases in dopamine release. This situation leads to the disruption of individuals' normal reward and motivation mechanisms, causing significant reductions in their daily functioning. Long-term addiction not only negatively affects memory and learning functions; it also leads to significant resistance and deficiencies in behavioural patterns, seriously reducing individuals' overall quality of life. Furthermore, the stress and anxiety brought on by addiction weakens individuals' social relationships and increases feelings of isolation, creating fertile ground for the development of mental disorders. This situation causes individuals to become weakened both psychologically and sociologically. Furthermore, the effects of addiction on brain plasticity cause permanent adaptations in brain structures and functions during the course of addiction. The interaction of genetic and environmental factors in these complex processes emerges as a decisive factor in determining individuals' susceptibility to addiction and their response to treatment processes. From a clinical perspective, neuropsychological assessments are crucial in the diagnosis and treatment of addiction; this relies on a detailed and systematic examination of the individual's cognitive and behavioural profiles. Preventive and therapeutic strategies focus on supporting neuroplasticity, incorporating methods that enable the brain to reorganise and restore its functions. Such processes help individuals cope more effectively with addiction while also ensuring the successful progression of the treatment process. Consequently, the complex relationship between addiction and the brain creates quite serious transformations from a neuropsychological perspective. A deep understanding of these transformations is crucial for designing effective interventions. In this context, multidisciplinary research and clinical applications are at the forefront as fundamental tools for better understanding the brain's adaptation mechanisms and reducing the negative effects of addiction. This makes it possible to develop innovative approaches to treating addiction. This situation makes providing the necessary support for individuals to lead healthy lives more important than ever before and leads to an increase in research in this area. All approaches applied in the process of combating addiction should be tailored to the needs of individuals and designed to be supportive. Since each individual's experience of addiction is different, creating personalised treatment plans is of vital importance. In this way, it will be possible to achieve more effective results and optimise treatment processes. When all these elements come together, an effective process for combating

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addiction can be established, and important steps can be taken to reintegrate individuals into society. At this point, developing integrated solutions in terms of mental and physical health will become a factor that facilitates individuals' exit from the cycle of addiction.

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