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Commentary

Drug addiction - How it hijacks our cognition & consciousness

The study by Sadananda *et al*[1] published in the current issue of the IJMR highlights the neurophysiological basis of altered cognition in subjects with opioid addiction. The study demonstrated aberrant network activity between the default mode network (DMN) and fronto-parietal attentional network (FAN) as a major cause for working memory deficits in drug addiction. Working memory is an important to retain the cognitive information essential for goal directed behaviours. Human beings are endowed with an efficient cognitive faculty of working memory, essential for efficient functioning of the executive network system of the brain[2]. As working memory is the key to carry out any cognitive process involving attention, volition, planning, goal directed behaviour, *etc.*, consciousness is linked largely to working memory processing[3,4]. The importance of integrating neuroscience knowledge especially the executive functions of human brain in leadership has been taught in neuro-leadership programs as a mean to maximize the human capabilities, productivity, creativity, leadership, wellness, positive attitude[5].

Aberrant network activities and structural deficits[6] in brain areas of executive functioning impede most of our intellect including mental flexibility, novel problem solving, behavioural inhibition, memory, learning, planning, judgement, emotion regulation, self-control and other social functioning[7]. Deficits in working memory and attention owing to reduced fronto-parietal network (FPN) activity is reported in schizophrenia, autism, attention deficit hyperactive disorder (ADHD) and anxiety disorders[8,9]. Opioid addiction is reported to impede such dynamicity of the executive system leading to a wide range of deficits in cognition[10,11]. Opioid addiction alters the network integrity between DMN and FPN networks and weakens the cognitive information processing in cognitively challenging paradigms[12]. Dysfunctional dynamics of DMN activity is believed to contribute to impaired self-awareness, negative emotions and addiction related ruminations[12]. Aberrant DMN activity and reduced medial prefrontal cortical functions are common neural phenotypes of cognitive deficits in conditions like mental illness, drug addiction, sleep deprivation and neurodegenerative disorders[13]. People with substance use disorders develop mental illnesses as a serious comorbidity that in turn, leads to severe behavioural impairments at the social, emotional and cognitive domains[14,15]. Chronic sleep deprivation associated with drug addiction and substance abuse is another predisposing factor that worsen the behavioural impairments[13]. Over all, drug addiction, substance abuse and the subsequent maladaptive behaviours including mental illness and sleep deprivation trigger a complex set of network instability in the domains of cognition and affect. The euphoria and hallucinating experience of drugs of abuse would soon lead to psychological distress and to cognitive and emotional behavioural impairments due to the disruption of various top down and bottom-up network dynamics[16].

Substance use disorders are an imminent socio-economic burden and have become a major public health concern worldwide. Despite knowing the harmful effects and consequences of drug use, reports say that the youth especially the adolescents have a tendency to continue the habit[17]. There is a need to have effective measures in place such as educational programmes to improve the self-efficacy of parents and family members to help their children to develop the right behavioural attitude, enhance the capacity building in teachers to strengthen the self-esteem and wellness of students to organize substance use control awareness programmes in coordination with NGOs at educational institutions, involvement of television and other visual and social media platforms to organise substance abuse control programmes and for interactive opportunity for children/youth with educators, researchers and professionals, organization of knowledge dissemination programmes to the public/schools/colleges to highlight the adverse effects of drug abuse on mental health and cognition. Introduction to such knowledge sharing platforms such as the Virtual Knowledge Network

(VKN) at NIMHANS, Bengaluru, provide interactive skill building opportunities to safeguard them from substance abuse and addiction. People should have easy access to such services and rehabilitation centers. Various behavioural intervention strategies such as cognitive retraining, psychotherapy, yoga therapy, mindfulness-based intervention programmes *etc*. are reported to improve cognitive abilities, regulation of negative emotions and restoration of motivational behaviours[18-21]. A study on single night exposure to olfactory aversive conditioning during sleep helped to quit addiction to cigarette smoking temporarily[22]. Such studies highlight the possibility of learning new behaviours during sleep and its positive impact on wake associated behaviours. Such approaches are quite useful, easily testable and cost-effective. Thanks to the incredible phenomenon of adult brain plasticity, it is possible to re-establish social intelligence, prosocial motivation among people with substance abuse.

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References

1. Sadananda S, Dastidar SG, Chitturi V, Balkara YPS, Sharma R, Kaur S. Electroencephalography cortical sources of working memory in the subjects with opioid addiction: A pilot study. *Indian J Med Res* 2021; *154* : 583-91.
2. Eriksson J, Vogel EK, Lansner A, Bergström F, Nyberg L. Neurocognitive architecture of working memory. *Neuron* 2015; *88* : 33-46.
3. Persuh M, LaRock E, Berger J. Working memory and consciousness: The current state of play. *Front Hum Neurosci* 2018; *12* : 78.
4. Piccoli1 T, Valente G, Linden DEJ, Re M, Esposito F, Sack AT, *et al*. The default mode network and the working memory network are not anti-correlated during all phases of a working memory task. *PLoS One* 2015; *10* : e0123354.
5. Gocen A. Neuroleadership: A conceptual analysis and educational implications. *IJEMST* 2021; *9* : 63-82.
6. Wang P, Zhou B, Yao H, Zhan Y, Zhang Z, Cui Y, *et al*. Aberrant intra- and inter-network connectivity architectures in Alzheimer's disease and mild cognitive impairment. *Sci Rep* 2015; *5* : 14824.
7. Uddin LQ. Cognitive and behavioural flexibility: Neural mechanisms and clinical considerations. *Nat Rev Neurosci* 2021; *22* : 167-79.
8. Yuan P, Raz N. Prefrontal cortex and executive functions in healthy adults : A meta-analysis of structural neuroimaging studies . Neuroscience and Behavioral Reviews 2014; *42* : 180-92.
9. Wong TY, Zhang H, White T, Xu L, Qiu A. Common functional brain networks between attention deficit and disruptive behaviours in youth. *Neuroimage* 2021; *245* : 118732.
10. Gould TJ. Addiction and cognition. *Addict Sci Clin Pract* 2010; *5* : 4-14.
11. Merrer JL, Me IR, Becker AJ, Befort K, Kieffer BL. Reward processing by the opioid system in the brain. *Physiol Rev* 2009; *89* : 1379-412.
12. Zhang R, Volkow ND. Brain default mode network dysfunction in addiction. *Neuroimage* 2019; *200* : 313-31.
13. Krause1 AJ, Simon EB, Mander BA, Greer SM, *et al*. The sleep-deprived human brain. *Nat Rev Neurosci* 2017; *18* : 404-18.
14. Ramey T, Regier PS. Cognitive impairment in substance use disorders. *CNS Spectrums* 2019; *24* : 1021-13.
15. Wills TA, Walker C, Mendoza D, Ainette MG. Behavioural and emotional self-control: Relations to substance use in samples of middle and high school students. *Psychol Addict Behav* 2006; *20* : 265-78.
16. Vollenweider FX, Preller KH. Psychedelic drugs: Neurobiology and potential for treatment of psychiatric disorders. *Nat Rev Neurosci* 2020; *21* : 611-24.
17. Tsering D, Pal R, Dasgupta A. Substance use among adolescent high school students in India: A survey of knowledge, attitude, and opinion. *J Pharmacy Bioallied Sci* 2010; *2* : 137.
18. Kim EJ, Bahk YC, Oh H, Lee WH, Lee JS, Choi KH. Current status of cognitive remediation for psychiatric disorders: A review 2018; *9* : 1-20.
19. Crowe M, Egglestone K, Douglas K, Porter RJ. Effect of psychotherapy on co morbid bipolar disorder and substance use disorder: A systematic review. *Bipolar Disorders* 2021; *23* : 141-51.
20. Petker T, Yanke C, Rahman L, Whalen L, Demaline K, Whitelaw K, *et al.* Naturalistic evaluation of an adjuvant yoga program for women with substance use disorders in inpatient treatment : Within treatment effects on carvings , self-efficacy, psychiatric symptoms, impulsivity and mindfulness . *Subst Abuse* 2021; *15* : 1-13.
21. Bowen S, Witkiewitz K, Clifasefi SL, Grow J, Chawla N, Hsu SH, *et al* . Relative efficacy of mindfulness based relapse prevention, standard relapse prevention, and treatment as usual for substance use disorders: A randomized clinical trial. *JAMA Psychiatry* 2014; *71* : 547-56.
22. Arzi A, Holtzman Y, Samnon P, Eshel N, Harel E, Sobel N. Olfactory aversive conditioning during sleep reduces cigarette-smoking behaviour. *J Neurosci* 2014; *34* : 15382-93.