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THE COGNITIVE FUNCTION WHILE PLAYING GAMING: BRIEF REVIEW STUDY ON GAMING.

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Abstract

In this millennial generation every individual is connected to technology and it has become the highest demand that every person need to have the basic knowledge about computer, technology, software and apps to which it also highlight about the dependency and involvement of the brain function in it. In this technological advancement it has become easy for an individual to download app of gaming and indulge in playing .The evolution in the gaming behavior is a serious action to be focus and studied in all round, because the current issues of a society is why children and adult like playing? What causes a person to play? Why get disturbed when not been played? etc. This study will focus on the several function of brain involved in the use of gaming and health issues. Several studies have proof how it has kept the brain active not knowing the impact, it has also lead to a addictive behavior outcome or some mental health issues. It's very important to know the several function of the brain involved in gamming whether it's online or offline. Regardless of how gamers have showed the ability to play consistently and the ability to control the function of brain amazed as those quick and fast forward action while playing is not seen in other activity, so the question arise which part of the brain is indulge in the activities of gaming? The new level of cognitive function in the involvement of the gaming activity has upgraded the function of brain interference in the development of brain. Gaming disorder is being classified in ICD resulting on the negative symptoms of behaviour so the association on the cognition function and behavior relation has a critical and serious pattern to justify how one could be mentally, physically and emotionally disturbed by gaming in an addictive manner.

Keywords: *Cognitive Function, Gaming, Mental Health.ICD*

INTRODUCTION

Gaming is one of the current influence trending amount adolescents as everyone is easily accessible to internet, gadgets and applications. Various studies have tried to labelled gaming as internet gaming disorder, problematic gaming, gambling or gaming disorder and also researchers working to include in the DSM 5(Diagnostic and statistical Manual) or ICD-11)International classification of disorders). The researchers recognizing problem gaming similar to the GD symptoms listed in the International Classification of Diseases - 11 (Stevens,Delfabbro and King 2020).

Over the past years the study about gaming addiction have boom in for researcher to find out why gaming is addictive? This gradually leads to psychological issues. Therefore a new topic and subject on psychopathology research and studies come out to be. Various researchers around the global have tried to figure out this issues and the study on it was done on all round examples: research conducted through FMRI, MRI, PET to see the function of brain images involved in gaming, studies about neurotransmitter and pathological problem.

To bring the gaming perspective researchers have work on to bring framework and diagnoses for the better understanding and contribution to include in the manual of disorders (Kuss 2013).Gaming is very common in adolescents now, resulting to aggression, delinquency and anxiety (Holtz and Appel 2010).In a qualitative research it was found that the subjects are aware of their own gaming behaviour and also give them the knowledge how to manage time (Stevens, Delfabbro, & King ,2020)

Shia,Renwicka , Turnerb , Kirsha,(2019) examined an Qualitative data with two main themes: meaningful and purposeful activity. Participants understood a sense of meaning and personal growth. Video gaming offered both positive and negative experiences in gamers' lives.Recently researcher are also interested in finding out how the brain function while gaming, which parts of the brain are involved.

The previous data studies shared that Gaming associated with changes of the brain regions which is responsible for attention and control, impulse control, motor function, emotional regulation, sensory-motor coordination. Furthermore, Internet game playing associated with lower white matter density in brain regions that are involved in decision-making, behavioural inhibition and emotional regulation(Dong,Wang, Du & Potenza. 2017).Accordingly the present study will bring out different researcher drawing out the function of brain using FMRI, PET,MRI, studies on neurotransmitters and psychological behavioural problem while gaming.

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METHODOLOGY

Literature Searches and Data Source: comprehensive and narrative review of literatures where collected from 3 databases: Google Scholar, PudMed, Frontiers. Studies were searched on about internet gaming disorder, brain function, psychological problems, gaming addiction, brain image
Inclusion Criteria: The fully accessible articles were viewed carefully. Studies which contain empirical and qualitative data were included. A studies which have been published from 2000 where included.
Exclusion Criteria: Article which did not show any related answer for the topic. Studies which study about gaming but doesn't specify about psychology issue, brain function and images were excluded.

LITERATURE REVIEW

A study of IGD group had lower FDG uptake in the left medial orbitofrontal gyrus, left middle cingulate cortex, left superior frontal gyrus, and right anterior cingulate cortex .Results suggesting that IGD may be associated with deficits of glucose metabolism in the prefrontal-cingulate cortices.(Kim , Jeong,Im, Lee and Chung 2021)
Chen, Huang, Yen, Chen, Liu, Yen, Ko (2015) studied to perform the Go/Nogo task under functional magnetic resonance imaging and reported right supplement motor area (SMA), dorsolateral prefrontal cortex to be active.
In addition to the researcher studies and finding brain dopamine D_2 (D_2)/Serotonin 2A ($5\text{-}HT_{2A}$) receptor function and glucose metabolism studied by using positron emission tomography (PET) imaging shows a significant decrease in glucose metabolism in the prefrontal, temporal, and limbic systems.D_2 receptors showed decreased glucose metabolism in the orbit frontal cortex (Tian, Chen, Zhang, Du, Hou, Chao & Zhang,2014)
In the previous studies of the internet videogame the IGD group showed increased activation in the right superior parietal lobule, right insular lobe, right precuneus, right cingulated gyrus, right superior temporal gyrus, and left brainstem. It have been known that Internet videogame play activates the vision, space, attention, and execution centers located in the occipital, temporal, parietal, and frontal gyrus.(Liu, Li, Zhou, Zhang, Wang, Zhang, & Li, 2016).
Kim, Baik , Park , Kim , Choi , Kim(2011) contributing to the understanding of neurobiological mechanism of Internet addiction reported that Individuals with Internet addiction showed reduced levels of dopamine D2 receptor availability in subdivisions of the striatum including the bilateral dorsal caudate and right putamen.
In the recent study a research was conducted on ID adolescents by using voxel-based morphometry (VBM) analysis on high-resolution T1-weighted structural magnetic resonance images. Resulting that IA adolescents had lower GMD in the left anterior cingulate cortex, left posterior cingulate cortex, left insula, and left lingual gyrus. (Zhou , Lin , Du , Qin , Zhao, Xu,Lei 2011)
Park, Kim, Bang , Yoon , Cho, Kim(2010) found that Internet game overusers showed greater impulsiveness than the normal users. OGA(Online Gaming Addiction) increase in ALFF amplitude of low frequency fluctuation values in the left medial orbitofrontal cortex (OFC), the left precuneus, the left supplementary motor area (SMA), the right parahippocampal gyrus (PHG) and the bilateral middle cingulate cortex (MCC)(Yuan, Jin, Cheng, Yang, Dong, Bi, Y & Tian,2013).
(Kim, Kim, Hughes, Kwak & Kong 2020) Multi-phase cross-sectional design was used to study Korean adolescent male internet gamers. Participants provided blood samples for assessment of norepinephrine (NE) and serum cortisol resulting four major categories of internet gaming reasons: entertainment, getting along with friends, stress relief, and habitual gaming. The habitual group showed greater risk of IGA and the lowest plasma NE levels.Also left amygdala with citalopram increasing and ATD decreasing the BOLD response to aversive outcomes also causing a low-risk decision (Macoveanu, Rowe, Hornboll, Elliott, Paulson, Knudsen & Siebner,2013).
In this factor gaming have negative impact on health, decision making, moods, compulsive behaviour. In contrast the finding in old age showed the prefrontal cognitive control system in the aging brain, and can be used to assess cognitive abilities across the lifespan, evaluate underlying neural mechanisms and serve as a powerful tool for cognitive enhancement (Anguera, Boccanfuso, Rintoul, Al-Hashimi, Faraji Janowich & Gazzaley,2013).
Diffusion tensor imaging data were collected and brain comparisons showed that IGD subjects demonstrated increased fractional anisotropy (FA) in the bilateral anterior thalamic radiation, anterior limb of the internal capsule, bilateral corticospinal tract, bilateral inferior fronto-occipital fasciculus, corpus collosum, and bilateral inferior longitudinal fasciculus (Dong, Wu, Wang, Wang, Du & Potenza (2018).
Functional connectivity in fMRI in striatal nuclei have showed that volumes Increased volumes of dorsal striatum (caudate) and ventral striatum (nucleus accumbens) and more errors on the Stroop task. Caudate volume correlated with Stroop task performance, and nucleus accumbens volume was associated with the internet addiction test score in the IGD group. (Cai, Yuan, Yin, Feng, Bi, Li, Y & Tian (2016). Another FMRI studies reported that internet addicts showed higher impulsivity, social anxiety and reduced emotional competence (Dieter, Hoffmann, Mier, Reinhard, Beutel,Klein,& Leménager,2017).

A study by (Sun, Wang, Han, Jiang, Ding, Cao & Zhou,2019) revealed that the ALFF values in the orbit part of left superior frontal gyrus (SFG) significantly decreased selectively in IGDm, which was negatively correlated with BIS-11(Barratt impulsiveness scale) score. Furthermore, IGDm also showed decreased connectivity between the orbit part of left SFG and posterior cingulate cortex (PCC), right angular gyrus (AG), and right dorsolateral prefrontal cortex (DLPFC).

Researching in the resting-state static functional connectivity (FC) of the dorsolateral prefrontal cortex (DLPFC) in subjects with IGD reported significantly lower static FC between the right dorsolateral prefrontal cortex(DLPFC) and the left rolandic operculum while higher static FC between the right DLPFC and the left pars triangularis when compared to HCs. The IGD decreased dynamic FC between the right DLPFC and the left insula, right putamen and left precentral gyrus, and increased dynamic FC in the left precuneus.(Han, Wu, Wang,Sun, Ding, Cao & Zhou ,2018).

Also in the findings by (Wang, Yin, Sun, Zhou, Chen, Ding, & Du ,2015) it was reported- IGD participants showed decreased VMHC between the left and right superior frontal gyrus (orbital part), inferior frontal gyrus (orbital part), middle frontal gyrus and superior frontal gyrus , suggesting evidence for the reclassification of IGD as a behavioral addiction.

The key finding reveals an increased correlated activity during rest in certain predefined resting state networks. Observed changes were mainly concentrated on parietofrontal networks involved in heterogeneous cognitive functions.(Martínez, Solana, Burgaleta, Hernández-Tamames,et.al. 2012.)

IGA group was hyperactive during No-Go trials in the left superior medial frontal gyrus, right anterior cingulate cortex, right superior/middle frontal gyrus, left inferior parietal lobule, left precentral gyrus, and left precuneus and cuneus. (Ding, Sun, Sun, Chen, Zhou, Zhuang, & Du,(2014).

In the suggest finding the function of response inhibition was impaired under gaming distraction and individuals with IGD could not activate right DLPFC and superior parietal lobe to keep cognitive control and attention allocation under gaming cue distraction. (Liu, Yen, Chen, Yen, Chen, Lin,& Ko 2014). Also in the study active compared with the passive condition more theta band power in frontal brain regions.Less alpha band power was found in the in the parietal, the occipital and the limbic cortex.(Havranek,Langer , Cheetham and Jäncke 2012)

The fMRI data studies post-hoc analyses have shown the precentral gyrus and thalamus, and activation in the striatum was associated with that in the inferior frontal gyrus and middle frontal cortex. Wang,Dong, Wang, Zheng & Potenza,2018).In gaming studies the subjects have showed higher activations when facing Internet gaming-related stimuli in regions including the inferior parietal lobule, the middle occipital gyrus and the dorsolateral prefrontal cortex which are involved in selective attention, visual processing, working memory and cognitive control. (Zhang,Lin,Zhou, Xu,Du & Dong ,2016).

LIMITATION

Firstly there was lack of research on FMRI,MRI and PET and neurotransmitter for longitudinal studies which could help find out the core part involved in gaming. Secondly lack of studies not different type of games verifying its different involvement in playing .Lastly most studies didn't compare, contrast and apply to the society and family rather study on the individual impact and involvement. Therefore,further studies could research considering these limitations.

CONCLUSION

The aim of this research provides brief review on the cognitive function while gaming. Major studies have shown how the brain structure functions and its impact while gaming. As the studies also support that game addiction is an addictive behavioural which support the diagnoses by DSM and ICD as a disorder which have been studied and researched by classifying from its epidemiology, pathology to psychology issues.

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