

Review

Impact of Internet Addiction on Mental Health: An Integrative Therapy Is Needed

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Keywords

Internet addiction · Internet gaming disorder · Attention deficit hyperactivity disorder · Mindfulness · Reward circuitry

Abstract

In the past few years internet addiction (IA) and internet gaming disorder (IGD) have become very frequent, leading to many personality and psychiatric disorders including low self-esteem, impulsivity, poor sleep quality, mood disorder, and suicide. IA has been included in Appendix III of the Diagnostic and Statistical Manual for Mental Disorders (DSM-5) as IGD. In addition, IA leads to many neuroanatomical and neurochemical alterations including cortical thinning of various components of the brain and altered dopaminergic reward circuitry. Due to widespread neuropsychiatric and neurobiological implications of IA, multiple therapeutic approaches are needed. Integrative therapy in the form of yoga and mindfulness has proven to be effective in many addiction disorders including IA.

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Introduction

The internet has become an integral part of modern day life, and the global population using the internet has grown to almost 3.8 billion [1]. Over the past few years, the study of the correlation between excessive internet use and mental disorders has grown. Young [2] first introduced the term internet addiction (IA) in a pioneering study and defined it as an impulse control disorder which does not involve an intoxicant. Thus, IA is a psychological dependence on the internet regardless of the type of activities pursued after logging in [3]. IA leads to an impairment of various life functions [4, 5]. Internet gaming disorder (IGD) is a consequence

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of IA, which is defined as uncontrolled internet gaming activity with negative impacts on the psychosocial functions [6]. The severity of IA and IGD is well established now, and in 2013 IA was included in Appendix III of the new version of the Diagnostic and Statistical Manual for Mental Disorders (DSM-5) as internet gaming disorder (IGD) [7]. Various diagnostic criteria for IA have been proposed [2, 8, 9]. Poor planning abilities, tolerance, impairment of control, and excessive online time were defined as the core symptoms. IA leads to many personality disorders [10–14].

Excessive internet use or IA and IGD are reported to be correlated with many psychiatric and psychosocial disorders that are reviewed in the present article. Structural alterations in internet-addicted brains and their implication have also been discussed. Integrative approaches such as yoga and mindfulness meditation have been proven to be effective as a de-addiction strategy to cure patients with IA.

Comorbidity of Psychiatric Disorders in IA

A lot of psychiatric disorders have been correlated with IA. It has been reported to be associated with low self-esteem [15], impulsivity [16], poor sleep quality [17], mood disorder [14], and suicide [18]. In an Indian context, a survey was conducted for IA which included 2,755 individuals (1,392 males and 1,363 females) in the age group of 18–65 years [19]. This study reported addiction in 1.3% individuals (2% males and 0.6% females). A study of 2,114 students (1,204 males and 910 females) diagnosed with IA using a self-report questionnaire revealed that individuals with IA had higher attention deficit hyperactivity disorder (ADHD) symptoms, depressive disorders, social phobia, and hostility particularly among male adolescents [20]. In another significant study regarding IA, four reliable and validated questionnaires were used: the young IA test, the insomnia severity index, the depression anxiety stress scale, and the Rosenberg self-esteem scale [21]. A total of 600 students (182 males and 418 females) aged between 18 and 28 years participated in this study. The potential IA prevalence rate was 16.8%, and a significant difference was found between males and females with a higher prevalence in males (23.6 vs. 13.9%). Furthermore, a strong correlation was found between IA and anxiety, stress, and depression [21]. Thus, the comorbidity of psychiatric disorders in IA is widely accepted.

Structural and Chemical Alterations in Brain with IA

It has been established in neuroimaging studies that IA is associated with structural and functional changes in brain regions involved in executive attention, decision making, emotional processing, and cognitive control [22]. Recently various morphometric studies on cortical centres of the brain with IA have found possible neural mechanisms. Brain regions which are involved in executive control, such as the orbitofrontal cortex, dorsolateral prefrontal cortex (dlPFC), and anterior cingulate cortex (Acc) showed decreased grey matter volume [23–26] and reduced cortical thickness [27, 28]. In addition, cortical volume loss in striatum and insular cortex is also measured [29, 30]. It has also been demonstrated in the internet-addicted brain that white matter integrity is impaired, and thus the proper connection and processing between the two hemispheres and connections among different lobes of the brain also get interrupted [22, 31]. Individuals with IA showed a larger volume in the hippocampus/amygdala than healthy controls [32]. Dopamine transporter is a protein situated in the presynaptic terminal and is responsible for the active reuptake into the presynaptic neuron, thus playing a critical role in the regulation of striatal synaptic dopamine levels [33]. The

Fig. 1. Normal neuronal circuitry in motivation-guided cognitive brain.

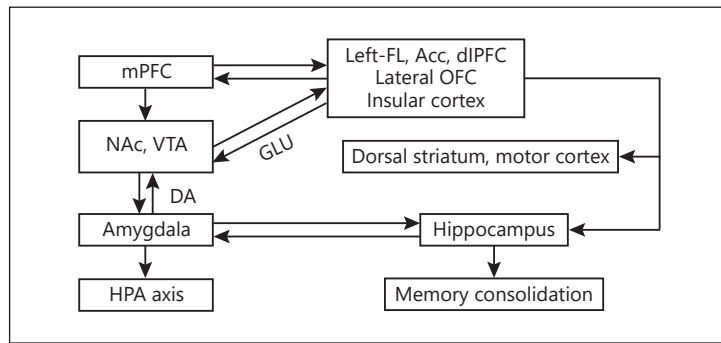
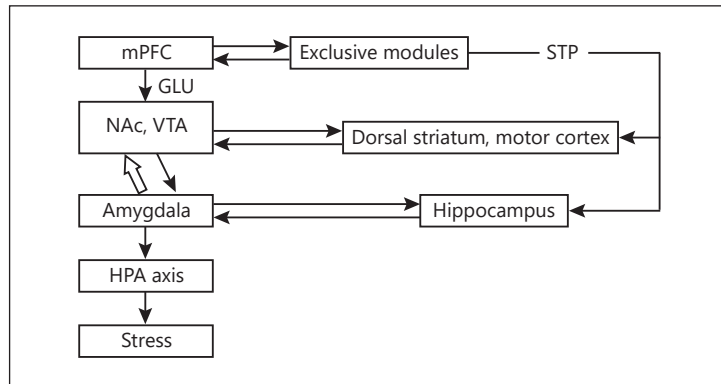


Fig. 2. Reward circuitry in addicted brain.



striatal dopamine transporter level was measured by single photon emission computed tomography in individuals with IA and brain scans were altered, and it was found that the dopamine transporter level of striatum was significantly decreased [34]. Further neuroimaging findings suggest that IA is associated with dysfunctions in the dopaminergic brain systems, and abnormalities in the dopaminergic neural system are similar in individuals with substance-related addiction [35].

Altered Reward Circuitry in the Addicted Brain

Studies based on positron emission tomography showed the direct role of dopamine in drug reward and addiction [36]. These findings also suggested the effect of addiction on motivation and executive functions of the brain. In the motivation-guided brain, there is an intricate but scrupulous neural circuitry connecting different executive and reward centres of the brain (Fig. 1). A conceived neuronal input through sense organs begins with the medial prefrontal cortex. After cortical processing, an electrochemical signal is sent to a set of highly interconnected neuronal areas including left frontal lobe, dlPFC, lateral orbitofrontal cortex, Acc, and insular cortex, which are the executive centres of brain responsible for goal-directed decision making [36]. Executive components of the brain transmit signals to striatum and motor cortex for decision-oriented movement. Further, these centres are connected to the hippocampus and amygdala for consolidation of memory. Moreover, medial prefrontal cortex is also connected with reward centres, ventral tegmental area, and nucleus accumbens (NAc). Internet gaming is associated with dopamine release similar in magnitude to that of drugs of abuse and lower dopamine transporter and dopamine D₂ receptor occupancy indicating subsensitivity of dopamine reward mechanisms [37]. Decreases in D₂ receptors in response

to drugs are proportional to dopamine increases [38]. Dopamine is involved in motivation through its regulation of target regions including NAc, Acc, orbitofrontal cortex, dlPFC, amygdala, dorsal striatum, and ventral pallidum [39]. According to the model postulated by Volkow et al. [36], in addiction-dominated reward circuitry, ventral tegmental area, NAc, hippocampus, and amygdala get highly activated; in contrast, executive components including prefrontal cortex and Acc are less significant. Activated amygdala induces hypothalamic-pituitary-adrenal (HPA) axis which enhances the level of adrenaline and cortisol in blood and generates stress (Fig. 2). However, a well-organized executive neuronal circuitry is needed for proper goal-oriented functioning of the brain that gets distorted in any sort of addiction including IA.

Integrative Approaches to Treat IA: Internet De-Addiction Programmes and Centres

Due to many comorbid psychiatric disorders related to IA and its severe impact on human health, many integrative therapeutic approaches are being adopted as an alternative form of therapy. Among the psychotherapeutic interventions, the most frequently used approaches have been cognitive and behavioural therapy and motivational enhancement therapy [40]. In most of the strategies employed to cope with IA, a moderate and controlled use of the internet is promoted rather than total abstinence. In the abstinence model, addicts abstain from a specific internet application and use alternative applications [41]. Therapeutic strategies employed for internet addicts who have lost their social connections and family support would include cognitive restructuring regarding the specific internet applications, behavioural exercises, and exposure therapy in which the offline time of the individuals is enhanced by engaging them in socio-educational activities. Eight therapeutic strategies suggested by Young [42] are highly relevant for IA. These include: (1) practice the opposite, in which the pattern of internet use is disrupted by suggesting a new schedule; (2) external stoppers, in which clients are exposed to real life events by replacing the online activities; (3) setting goals, in which specific achievable goals are scheduled for clients; (4) abstinence from certain applications, in which the most attractive and uncontrollable application of the internet is encouraged for abstinence; (5) reminder cards are designed for clients to remind them of the benefits of breaking the addiction; (6) personal inventory, in which clients are encouraged to explore new activities that they have compromised at the cost of internet use; (7) support group for social interaction is provided; (8) family therapy, in which family interventions are encouraged to address relational problems that may have resulted from IA [43]. With the motivation enhancement therapy technique, an individualized treatment plan and an attainable goal are set with a collaborative, non-confrontational effort between the individual and the therapist [44]. The therapeutic relationship between client and expert is more like a partnership or companionship than an expert relationship to resolve the ambivalence. A web-based IA recovery facility has been designed (www.netaddiction.com) that provides e-counseling, on line support groups, tapes, and self-help books to cope with IA [43]. In Southeast Asian countries the adverse impact of IA has been taken seriously and has led to a series of studies and social work by the government and health care givers to curb and alleviate the problem [45]. India opened its first internet de-addiction centre in 2014 at the National Institute of Mental Health and Neurosciences (NIMHANS), Bengaluru, as a Service for Healthy Use of Technology (SHUT) centre [43]. After proper diagnosis, addicted patients particularly children and adolescents are given motivation enhancement therapy and psychoeducational training. Time management techniques and family sessions are also held. Stretching exercises to relax, games, yoga, and mindfulness meditation are also practiced as a de-addiction

programme [44]. Likewise many specialized care giving programmes and treatment centres have been established in European countries including Germany and the UK (London) [45]. In Seattle the RESTART Internet Addiction Recovery Programme and in Pennsylvania the Digital Detoxification and Recovery Centre have been established [45]. In the RESTART programme, a community-based programme works with individuals, couples, and families to recognize the problematic use of the internet and an individualized programme is designed to promote a healthy, balanced life. Mentoring and coaching life skills, health and fitness exercise programmes, weekend adventure and recreational activities, and mindfulness-based stress reduction programmes are few de-addiction strategies adopted by RESTART. The Korean government has framed a network of 190 IA counseling centres and hospitals. In Korea, the first specialist clinic for IA was established in 2011, where a 5-week treatment module is offered, which includes group sessions, art therapy, medication, neurofeedback, and transcranial magnetic stimulation [46]. China has more than 300 treatment centres that include behavioural training and medication for addicts like dancing, reading, sports, and elements from the 12-step programmes of the Alcoholic Anonymous along with family therapy [47]. The Japanese Ministry of Education has recognized the severity of IA, and it has started withdrawal camps for internet-addicted children [48]. However, these technology de-addiction centres and programmes based on an integrative approach are emerging worldwide.

Yoga and Meditation as an Integrative Therapy for IA

Among the integrative approaches to treat addiction, yoga and mindfulness have been proven as a potential complementary therapy. The therapeutic effects of yoga are widely studied concerning a multitude of various ailments and conditions including common symptoms of IA-like stress, anxiety, depression, and poor sleep quality. Therapeutic yoga is defined as the application of yoga postures and practices to the treatment of health conditions and involves instruction in yogic practices and teachings to prevent or reduce structural, physiological, emotional and spiritual pain, suffering or limitations [49]. In the western world yoga is now regarded as a holistic approach and is recognized by the National Institute of Health as a form of complementary and alternative medicine [50]. Yoga is a form of mind-body fitness involving a combination of muscular activity and internally focused awareness of the self, breath, and energy. In the western world, the most common aspects of yoga are the physical postures and breathing exercises of Hatha yoga and meditation [51]. The basic principle of yoga reveals that the human body is an integrative system of various interrelated and inseparable dimensions; thus, health or illness of one dimension affects the other dimensions. Moreover, healing comes from within and a greater sense of autonomy is achieved through yoga [49]. In the famous Indian scripture *Yoga Sutras*, Patanjali describes the eight limbs of yoga called *ashtanga* [52, 53]. Based on the eight limbs of Patanjali, many yogic disciplines have been developed and each has its own technique for the treatment of diseases particularly stress-related ailments such as IA. Among the various forms of Hatha yoga, Iyengar yoga is highly studied and popular [50]. The breathing techniques of Hatha yoga focus on prolonged inhalation, breathing retention, and relaxation. Further, a homeostasis is maintained during the body posture between body system, breath, and concentration. Yoga practices enhance body flexibility and muscular strength, improved respiratory and cardiovascular function and overall well-being. Although direct studies regarding the efficacy of yoga in IA are scarce, a number of studies demonstrates the potential benefits of yoga practices on poor concentration, depression, anxiety, stress, and insomnia [49], which are the comorbid symptoms of IA. The common components of yoga include various postures or asana (body

movements), conscious breathing, meditation, lifestyle and diet change, visualization and the use of sound [54]. Yoga promotes relaxation, lower breathing rate, focus on the present and inhibition of the sympathetic area of hypothalamus [55]. Consistent yoga practice improves depression, increases in serotonin levels, and decreases the levels of cortisol and monoamine oxidase [55]. In yoga, restorative postures, pranayama (breathing exercises), meditation, savasana (body in complete relaxation), and pratyahara (a turning inward of the senses) increase relaxation and improve sleep quality [49]. Mindfulness meditation has been found to be highly effective for the treatment of ADHD [56], one of the key psychiatric disorders related to IA [19, 20]. Mindfulness meditation or mindfulness training (MT) is derived from Buddhist practices and is practiced as a type of focused, non-judgmental attention on purpose in the present moment and with non-judgmental acceptance. Basic elements of MT are intention, attitude, and attention [56]. For the therapeutic purposes, two types of meditation practices are well recognized: focused and receptive attention. In focused or concentrative meditation, the meditator focuses on a specific thought such as an image or a body sensation, disregarding the distracting events [57]. Mindfulness of breathing is a common practice in focused attention, where a participant is trained to focus on his/her breathing and sustain attention on the present moment. In receptive attention or open monitoring, the participant observes the content of his/her experience like sensations, thoughts, and emotions, from moment to moment without reaction. Thus, receptive attention improves self-regulation and impulse control, which is needed for the treatment of addictive behaviour including IA. A study was conducted on 24 adults and 8 adolescents with ADHD who were treated with 8 weeks of MT along with home assignments [58]. In this study participants started meditating for 5 min at a time, which was gradually increased to 30 min. Each session comprised 2.5 h and was supplemented with daily home practice. The results were promising with 78% completing the study and 30% reporting a greater than 30% reduction in symptoms of ADHD. The authors concluded that an 8-week MT adapted for adolescents and adults with ADHD was feasible. Due to the lack of a control group, however, it was not clear whether the improvement was the result of MT or non-specific factors [56]. In another significant study on feasibility and acceptability of mindfulness meditation for adults with ADHD [59] a sample of 11 adults was studied and compared to a control group of 11 with MT. In this treatment group 63.6% also showed a 30% reduction in ADHD symptoms compared to a 0% reduction in the control group in the self-rating scale. These studies show evidence of acceptability and feasibility in MT [59]. Studies on the brain activation before and after variable periods of MT using fMRI have shown that during MT attention-related cortices such as the prefrontal cortex and Acc get activated [60].

In a significant review by Khanna and Greeson [61] on yoga and mindfulness as complementary therapies for addiction, it is suggested that the skill, insights, and self-awareness through yoga and mindfulness practices can target multiple psychological, neural, physiological, and behavioural processes implicated in addiction and relapse. Moreover, in a review [61], various meditation-based training programmes which are effectively employed for the treatment of various addictions, such as mindfulness-based relapse prevention, MT for smoking cessation, and mindfulness-oriented recovery enhancement, have been properly described. Mindfulness-based relapse prevention is an 8-week manualized programme which incorporates cognitive-behavioural skills with mindfulness-based practices to decrease relapse by increasing awareness [62]. Since IA has the same implications as other forms of addictions, it has been suggested that the efficacy of various forms of yoga, meditation, and MT as an integrative medicine is feasible. Thus, yoga and meditation should be treated as a complementary therapy for medical therapy in the treatment of stress, anxiety, depression, and other psychiatric addictive disorders such IA, since it increases self-confidence, mind relaxation, and attentiveness, and decreases irritability.

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