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INFO-DIGITAL ADDICTION: AN INTERDISCIPLINARY ANALYSIS OF THE PHENOMENON, ITS CRITERIA, AND CONSEQUENCES

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This article presents an interdisciplinary analysis of the phenomenon Info-Digital Addiction (IDA) as a novel form of behavioral addiction, characterized by neurophysiological, physiological, cognitive, psycho-emotional and social consequences. The study is based on a systematic review of contemporary scientific publications, as well as a comparative analysis of diagnostic criteria for various forms of behavioral addictions. The mechanisms of IDA formation are examined, including neurophysiological and physiological changes such as dopaminergic imbalance, chronic stress, circadian rhythm disruption and impaired cognitive control and etc. The primary forms of this addiction are identified. Special attention is given to diagnostic criteria and the projected evolution of IDA in the context of widespread digitalization. Preventive strategies are proposed, encompassing educational, medical, and social interventions. The necessity of further research on the disorder's impact on human physiology, brain neuroplasticity, social adaptation and public health is emphasized.

Keywords: *addiction, information-digital addiction, cognitive impairment, neurophysiology, behavioral addiction, psycho-emotional consequences, chronic stress*.

DEPENDENŢA INFORMAŢIONAL-DIGITALĂ: O ANALIZĂ INTERDISCIPLINARĂ A FENOMENULUI, CRITERIILOR ŞI CONSECINŢELOR ACESTUIA

Articolul prezintă o analiză interdisciplinară a fenomenului dependenței informațional-digitale (DID) ca o nouă formă de adicție comportamentală, având consecințe neurofiziologice, fiziologice, cognitive, psihoemoționale și sociale. Studiul se bazează pe o revizuire sistematică a publicațiilor științifice actuale, precum și pe o analiză comparativă a criteriilor de diagnostic ale diferitelor forme de dependențe comportamentale. Sunt examinate mecanismele de formare a DID, inclusiv modificările neurofiziologice și fiziologice, cum ar fi dereglarea sistemului dopaminergic, stresul cronic, alterarea ritmurilor circadiene, reducerea controlului cognitiv etc. Au fost identificate principalele forme ale acestei dependențe. O atenție deosebită este acordată criteriilor de diagnostic și prognozei evoluției acestei adicții în contextul digitalizării accelerate. Sunt propuse strategii de prevenire, care includ măsuri educaționale, medicale și sociale. Se subliniază necesitatea continuării cercetărilor asupra impactului acestei tulburări asupra fiziologiei umane, neuroplasticității creierului, adaptării sociale și sănătății publice.

Cuvinte-cheie: *dependență, dependență informațional-digitală, tulburări cognitive, neurofiziologie, adicție comportamentală, consecințe psihoemoționale, stres cronic.*

Introduction

The rapid development of digital technologies has contributed to the emergence of new types of behavioral addictions, among which Info-Digital Addiction (IDA) holds a significant place. This phenomenon extends beyond traditional internet or gaming addictions [1], encompassing a broad spectrum of digital activities, including social media, video streaming, news consumption, cybersexual addiction, information overload and numerous other forms of excessive interaction with the digital environments. IDA represents a pressing scientific and socio-medical problem that demands a comprehensive interdisciplinary approach, integrating human physiology, cognitive neuroscience, clinical psychology, psychiatry, and sociology.

Recent studies confirm that various subtypes of this behavioral addiction lead to neurophysiological, cognitive, and psycho-emotional disorders, as well as systemic physiological changes, making it a critical issue in medicine, psychology, and social sciences [2, 3, 4]. However, precise diagnostic criteria for IDA remain a subject of scientific debate. While this phenomenon was previously attributed to individual personality traits, contemporary research highlights its systemic nature, linked to brain function alterations, physiological reactions, social factors, and the algorithms of digital platforms [5].

This study is based on an interdisciplinary analysis that includes human physiology, cognitive neuroscience, clinical psychology, psychiatry, and social sciences. Particular emphasis is placed on the neurophysiological and physiological mechanisms of IDA formation, as well as its psycho-emotional and social consequences.

The prevention and diagnosis of this disorder are particularly important in the context of physiology, neuroscience, and cognitive research, as prolonged exposure to digital stimuli can alter neuroplasticity mechanisms, leading to impairments in executive functions, attention, memory, and emotional regulation [6]. Additionally, given the accelerated development of digital technologies, it is necessary to anticipate the emergence of new forms of IDA, including pathological interactions with artificial intelligence, metaverses, digital assistants, and other innovative digital tools.

Methods and materials

This study is based on a systematic analysis of peer-reviewed scientific publications, meta-analyses, and empirical data on digital, technological, internet, computer, and information addiction, published between 2010 and 2024. The included sources were selected from PubMed, Scopus, and Web of Science databases based on their relevance to the research topic, methodological rigor, and the availability of objective data on the neurophysiological, physiological, cognitive, psycho-emotional, and social aspects of the addictions under consideration. The following methods were used to achieve the study's objectives:

1. Content analysis of publications in leading peer-reviewed scientific journals in psychology, physiology, neuroscience, and social medicine, focusing on behavioral addictions, cognitive and physiological changes in the context of digitalization.
2. Comparative analysis of diagnostic criteria for internet addiction, video game addiction, compulsive content consumption, social media addiction, and digital, technological, and information addictions.
3. Neurophysiological and physiological analysis of the impact of digital content on cognitive and psycho-emotional processes, including the study of dopamine regulation mechanisms, changes in the prefrontal cortex and limbic system, as well as the effects of information overload on memory processes, concentration, and emotional state.
4. Meta-analysis of clinical data on the effects of the above-mentioned types of addiction on brain neuroplasticity and physiological parameters.
5. Analysis of social and somatic aspects of various forms of IDA.

Results and discussion

In the context of the pervasive digitalization of modern society, Info-Digital Addiction (IDA) is emerging as one of the most significant issues, affecting all aspects of human life. The conducted analysis has made it possible to systematize the key characteristics of this phenomenon, refine its definition, identify the primary mechanisms of its formation, and assess its potential consequences.

We propose defining IDA as a form of behavioral addiction, characterized by compulsive and excessive consumption of digital information (social media, online/offline video games, video streaming, news, etc.) through digital devices. This, in turn, leads to significant negative consequences, affecting neurodevelopmental trajectories, cognitive, psycho-emotional, and physical health, as well as social adaptation.

IDA is multifaceted and complex in nature, often combining several interrelated aspects of digital activity simultaneously. As a rule, it is marked by the combination of several addictive forms of interaction with information and communication technologies (ICT). This not only complicates the diagnosis but also necessitates an interdisciplinary approach to studying the phenomenon, defining its diagnostic criteria, and

developing potential prevention and correction strategies. Defining diagnostic criteria for IDA is a crucial step in understanding this disorder. It allows for differentiation between IDA and other forms of behavioral addiction and serves as a foundation for development of early detection and correction methods. The key diagnostic criteria include:

- Loss of control over digital consumption – the inability to limit time spent on digital devices, despite awareness of its negative consequences [1].
- Prioritization of digital activity over real-life engagement – a decline in interest in education, work, and social interactions in favor of digital content [4].
- Psychophysiological consequences – anxiety, emotional instability, sleep disturbances, headaches, reduced concentration, etc. [1].
- Development of withdrawal syndrome – irritability, anxiety, and depressive manifestations in the absence of access to digital devices and content [1].

Defining clear diagnostic criteria for IDA is an essential prerequisite for further research into its mechanisms of formation, as well as for the development of effective prevention and treatment strategies. Research suggests that the mechanisms underlying technological/digital addictions are associated with the influence of digital platform algorithms, which trigger the so-called “dopamine trap”, induce structural changes in the brain, leading to reduced cognitive control, and contribute to information overload, which in turn fosters anxiety disorders and depression [1, 4, 6, 7, 8, 9]. Depending on the specific type of digital interaction, various forms of IDA can be identified. Some of these exhibit a traditional nature and have already been studied within the framework of behavioral addictions, while others are emerging in response to new technological trends. Among the most common, so-called classic forms of this addiction, the following stand out:

- Social media addiction – an uncontrolled urge for continuous engagement with social platforms (TikTok, Instagram, Facebook, etc.) accompanied by anxiety, reduced productivity, and impaired concentration.
- Gaming addiction – excessive involvement in online/offline video games and virtual worlds, leading to cognitive impairments, increased impulsivity, and decreased social activity.
- Compulsive news consumption – an uncontrollable desire to constantly consume information flows. This behavior may contribute to the development of anxiety disorders, cognitive overload, impaired critical thinking, and heightened sensitivity to negative events.
- Video content addiction – pathological overconsumption of video content (YouTube, Netflix, etc.), often resulting in circadian rhythm disruptions, procrastination, and reduced cognitive flexibility.
- Cybersexual addiction – compulsive consumption of pornographic content or excessive involvement in virtual relationships. This can lead to a decline in emotional intimacy and impaired socialization.
- Obsessive Digital Rituals – endless scrolling, constant refreshing of feeds, and switching between tabs. This behavior is often accompanied by anxiety when access to digital devices and platforms is restricted.

However, modern technologies continue to evolve, creating conditions for the emergence of new forms of addiction, among which the following stand out:

- Artificial Intelligence (AI) Addiction – excessive reliance on AI assistants, chatbots, and personalized recommendations, which can reduce independent decision-making abilities.
- Metaverse (VR/AR) Addiction – complete immersion in digital worlds, leading to a loss of connection with real life and impaired social adaptation.
- Smart Home and IoT Addiction – obsessive control over the operation of digital devices, resulting in anxiety when access to them is lost.

This list represents only a fraction of the possible variations and combinations of IDA. In this context, it is important to highlight that the formation of IDA is linked to profound changes in brain function and overall physiological processes. Research indicates that digital products, due to covert manipulations deliberately introduced by developers, activate reward mechanisms and can induce neurological changes similar to those observed in chemical addictions, particularly substance dependence [5, 10, 11, 12, 13]. Thus, the key neurophysiological mechanisms of IDA are:

- The "Dopamine Trap" – Digital platform algorithms leverage dopamine reinforcement mechanisms, triggering instant rewards (likes, comments, views), which lead to elevated dopamine release and addiction formation.

- Reduced Prefrontal Cortex Activity – Individuals with pronounced IDA exhibit impaired cognitive control, decreased critical thinking abilities, and increased impulsivity.

- Information overload, excessive consumption of digital content leads to cognitive strain, reduced attention span, increased anxiety, and chronic fatigue.

Prolonged and uncontrolled interaction with digital devices not only affects cognitive processes but also leads to significant changes in physiological functioning. The physiological consequences of IDA include:

- Disruption of circadian rhythms – Exposure to screen light, particularly during evening and nighttime hours, suppresses melatonin production, resulting in reduced sleep quality, difficulty falling asleep, fragmented sleep, and, consequently, chronic sleep deprivation. Sleep deficiency, in turn, impairs cognitive abilities, reduces memory and attention, and may increase anxiety levels and the risk of depressive disorders.

- Chronic stress and elevated cortisol levels – Continuous stimulation of the brain by digital stimuli activates the sympathetic nervous system, leading to increased secretion of the stress hormone cortisol. This state is associated with various negative effects, including immune system suppression, elevated blood pressure, dysfunction of the hypothalamic-pituitary-adrenal axis, and a heightened risk of cardiovascular diseases.

- Physical inactivity and musculoskeletal disorders – A sedentary lifestyle, characteristic of prolonged interaction with digital devices, contributes to muscle imbalances, poor posture, scoliosis, osteochondrosis, and chronic back pain. Prolonged static positioning while using gadgets also impairs blood circulation, increasing the risk of varicose veins, lymphatic stagnation, and thromboembolism.

- Metabolic disorders – Reduced physical activity combined with continuous digital stimulation promotes the development of metabolic syndrome, obesity, insulin resistance, and an increased risk of type 2 diabetes. Disruptions in eating habits, such as frequent snacking in front of screens, late-night meals, and a lack of mindful eating, exacerbate these negative effects.

- Decline in visual function (digital eye strain syndrome) – Prolonged screen use places excessive strain on vision, potentially leading to asthenopia (eye fatigue), dry eye syndrome, accommodation spasm, and progressive myopia. Blue light exposure also negatively impacts the retina, increasing the risk of degenerative changes.

- Impairment of sensory integration – Excessive interaction with digital devices creates "sensory overload," where the brain receives an overwhelming amount of visual and auditory stimuli, thereby hindering the ability to focus on a single task and potentially inducing increased irritability, anxiety, and reduced productivity.

The list of threats posed by IDA to human somatic health is quite extensive. Research indicates that the physiological consequences of IDA affect a wide range of bodily systems, influencing quality of life, cognitive health, and overall physical well-being. Given these risks, it is crucial to focus on preventive measures aimed at early diagnosis, mindful use of digital technologies, and the development of healthy behavioral strategies within the digital environment [14, 15].

The impact of IDA on individuals is multifaceted, encompassing all aspects of life, including psycho-emotional and social dimensions, significantly affecting emotional well-being, behavioral patterns, and social adaptation. Affective disorders such as anxiety, depressive states, and emotional instability are common among individuals exhibiting pronounced signs of IDA, largely driven by mechanisms of dopamine reinforcement and information overload. Moreover, this addiction contributes to the formation of new social behavior models, frequently associated with a decline in communication skills, social isolation, and a loss of interest in offline interactions. These changes not only deteriorate individuals' quality of life but also influence social institutions, including family dynamics, the educational environment, and the labor market [1, 16, 17, 18].

Notably, the psycho-emotional and social negative aspects of IDA manifest as follows:

- Affective disorders – Prolonged use of digital technologies can trigger anxiety, depression, and emotional instability.
- Cognitive impairments – Studies confirm a decline in attention span, memory impairment, and the development of „fragmented thinking.”
- Social isolation – Individuals with pronounced IDA symptoms replace real-life communication with digital interactions, increasing social anxiety levels and impairing communication skills.

Given the increasing digitalization and its negative impact on the psycho-emotional state of individuals, comprehensive preventive strategies and intervention measures are essential. Thus, promising directions for prevention may include the development of digital detox technologies, the implementation of digital hygiene programs, and neurophysiological monitoring of individuals at high risk of developing IDA. Based on an interdisciplinary approach, the following measures can be proposed for effective implementation:

Medical Aspect

- Development of biomarkers for diagnosing Information-Digital Addiction (IDA) to enable early detection of dependency symptoms.
- A key area of focus is the discussion regarding the inclusion of IDA in future versions of international diagnostic classifications.
- Implementation of neuropsychological testing to assess cognitive changes in individuals at high risk of developing IDA.

Educational Aspect

- Integration of digital hygiene courses into educational curricula to foster skills for mindful technology use.
- Development of cognitive strategies to manage information overload and improve self-regulation of digital consumption.

Social Aspect

- Governmental regulation of digital platforms aimed at restricting algorithms that contribute to addictive behaviors.
- Creation of public awareness programs promoting responsible digital consumption.

Given the rapid evolution of digital technologies and the growing trend of increasing IDA cases, it is crucial to anticipate the potential consequences of this phenomenon. Diagnostic and intervention methods must be adapted to the emerging challenges of the digital era. Furthermore, continued research in this field is of fundamental importance.

Conclusions

Based on the findings of this study, the following conclusions can be drawn:

1. IDA encompasses a broad spectrum of human interaction with ICTs and represents an interdisciplinary problem that requires a comprehensive approach to diagnosis, prevention, and intervention.
2. The mechanisms underlying IDA are associated with dysregulation of the dopaminergic system, reduced cognitive control, and functional changes in the prefrontal cortex.
3. The cognitive and psychological and emotional consequences of IDA include fragmented thinking, diminished attention span, memory impairment, anxiety disorders, depression, sleep disturbances, and decreased social adaptation.
4. The dynamic development of technology necessitates the continuous updating and adaptation of diagnostic criteria.
5. IDA diagnosis requires the implementation of objective biomarkers, the inclusion of this disorder in international disease classifications, and the development of tools for assessing cognitive impairments.
6. Prevention of IDA should incorporate medical, educational, and social measures.
7. Future research should focus on further investigating the impact of IDA on neuroplasticity, social adaptation, and public health. It is essential to forecast the emergence of new forms of digital addiction associated with technological advancements, such as artificial intelligence, metaverses, and augmented reality, and to develop effective strategies for their prevention and mitigation.

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