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List of Abbreviations

AMPA	α -Amino-3-hydroxy-5-methyl-4-Isoxazolepropionate
AORs	Adjusted Odds Ratios
APA	American Psychiatric Association
BF	Basal Forebrain
CDC	Centers for Disease Control And Prevention
CREB	cAMP Response Element Binding Protein
CTP	Center for Tobacco Products
DA	Dopamine
DSM	Diagnostic and Statistical Manual of Mental Disorders
fMRI	Functional Magnetic Resonance Imaging
FTND	Fagerström Test for Nicotine Dependence
GATS	Global Adult Tobacco Survey
GABA	Gama Amino Buteric Acid
GP	Globus Pallidus
IAD	Internet addiction disorder
IADDC	Internet Addictive Disorder Diagnostic Criteria
IAT	Internet Addiction Test
IGD	Internet Gaming Disorder
LWDS	Lebanon Waterpipe Dependence Scale
MAO	Monoamine Oxidases
MSNs	Medium Spiny Neurons

List of Abbreviations

NAcc	Nucleus Accumbens
nACHRs	Nicotinic Acetylcholine Receptors
NMDA	N-Methyl-D-Aspartate
NRT	Nicotine Replacement Therapy
OCD	Obsessive Compulsive Disorder
OFC	Orbitofrontal Cortex
PET	Positron Emission Tomography
PIU	Problematic Internet Use
R	Pearson`s Correlation Coefficient
ROI	Regions of Interest
SCC	Subcallosal Cortex
SD	Standard Deviation
SES	Socioeconomic Status Scale
SN	Social Network
SPECT	Single Photon Emission Computed Tomography
SPSS	Statistical Package for the Social Sciences
USA	United States of America
VTA	Ventral Tegmental Area
WHO	World Health Organization

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ABSTRACT:

Background: Recently, there has been an interesting clinical and scientific shift in perspective with many believing that addiction should encompass the compulsive engagement in activities such as smoking, Internet use, and gaming, in addition to its conventional relation with pharmacologic rewards (*Grant et al., 2006*). **Aim of the work:** This study is considered a comparative observational cross sectional study aiming to assess the frequency of nicotine dependence, internet addiction and internet gaming disorder among the selected sample. Also, it is aiming to assess the essential risk factors on internet addiction, internet gaming disorder and nicotine dependence. Finally, it aims also to compare the frequency and co-occurrence of internet addiction and internet gaming disorder versus nicotine dependence among the selected sample. **Subjects and methods:** All subjects of the study were compared according to Socioeconomic Status scale, Fagerström Test for Nicotine Dependence, Lebanon Water-pipe Dependence Scale-11, Internet Addiction Test and Internet Gaming Disorder scale. There were also other questions describing the internet use, internet gambling, internet pornography and pattern of tobacco smoking. **Results:** It was found that the frequency of nicotine dependence is within (and sometimes less than) the global prevalence found in recent studies through the different forms of tobacco smoking, however the usage of new tobacco products e.g. vape and e-cigarettes became more frequent than before. Meanwhile, internet addiction and internet gaming disorder are currently more frequent than expected. It was found that gender and socioeconomic status play an effective role in severity of nicotine dependence and internet gaming disorder however they are not related to internet addiction. Meanwhile, the type of faculty is not related to any of nicotine dependence, internet gaming disorder and internet addiction. However age as a risk factor couldn't be assessed due to the narrow age range between the students. **Conclusion:** It was found that there is positive correlation between internet addiction, internet gaming disorder with nicotine dependence which proves that addictions are sharing a similar neurobiological vulnerability.

Key Words: Internet, Addiction, Nicotine, Tobacco, Gaming, Pornography

INTRODUCTION

Addiction is a medical condition characterized by compulsive engagement in rewarding stimuli, despite adverse consequences (*Angres & Bettinardi-Angres, 2008*). It is considered a disorder of the brain's reward system which arises through transcriptional and epigenetic mechanisms and occurs over time from chronically high levels of exposure to an addictive stimulus (*Ruffle, 2014*).

Addictive stimuli can be either a substance or behavioral addiction. The substances that are considered to be addictive are mentioned in DSM-5 as substance use disorders (*APA, 2015*). Behavioral addictions have been proposed as a new class in DSM-5, but the only category included is gambling disorder. Internet gaming disorder is included in the appendix as a condition for further study (*Kuss & Daria, 2013*).

Nicotine is considered one of the main psychoactive ingredients in tobacco (*Stolerman & Jarvis, 1995*). Its dependence is mentioned in DSM-5 as tobacco use disorder (*APA, 2015*). It is considered highly addictive (*Grana et al., 2014*). It binds with nicotinic receptors in the brain and releases a variety of neurotransmitters, including dopamine, which, in turn, produce the pleasurable effects associated with smoking. With repeated exposure to nicotine, the

number of binding sites on nicotinic receptors in the brain increases. When these receptors are not occupied by nicotine, they are believed to produce withdrawal symptoms (**Benowitz, 2010**).

Moreover, several behaviors (besides psychoactive substance ingestion) produce short-term reward that may engender persistent behavior despite knowledge of adverse consequences. Since, diminished control is a core defining concept of psychoactive substance dependence or addiction, this similarity has given rise to the concept of non-substance or “behavioral” addictions but with a behavioral focus other than ingestion of a psychoactive substance (**Potenza, 2006**).

Preclinical evidence has demonstrated that over expression of Δ FosB (a transcription factor that plays an important role in development and maintenance of pathological behavior and neural plasticity) through repetitive and excessive exposure to a natural reward i.e. the addictive behavior induces the same behavioral effects and neuroplasticity as occurs in a drug addiction (**Pitchers et al., 2013**).

Internet use is one of the identified behaviors to be addictive. Internet addiction is considered a global phenomenon that has been a topic of increasing interest to

clinicians, researchers and stakeholders such as teachers, parents and community groups. It is also called Problematic Internet Use (PIU) (*Moreno et al., 2013*).

There are five general subtypes of Internet addiction that were categorized based upon the most problematic types of online applications, and they include addictions to Cybersex and internet pornography, Cyber-relationships, online stock trading or gambling, information surfing, and computer games (*Young, 1999*).

As for cybersex, it is defined as a virtual sex encounter in which two or more people connected remotely via computer network send each other sexually explicit messages describing a sexual experience. While internet pornography means any pornography that is accessible over the Internet.

Meanwhile, internet gambling means the use of internet in the act of gambling. Since the beginning of widespread introduction of the internet into domestic settings, the number of online gambling sites has increased at a staggering rate each year (*Basham & White, 2002*). This facilitates the gambling opportunities. Consequently, it has been asserted that the easy access to gambling provided by Internet modes may lead to the development or exacerbation of gambling problems (*Watson et al., 2004*).

As previously stated, Internet Gaming Disorder (IGD) is a “Condition for Further Study” in the DSM-5 (APA, 2013). Of all online activities, online gaming has the strongest association with compulsive Internet use (Van Rooij et al., 2010). Excessive computer game playing without monetary rewards is considered problematic (Johansson & Gotestam, 2004).

There are also other forms of internet addiction understudy nowadays. Social Networks (SN) for example have been widely disseminated among children, teenagers and adults. The gratification brought by the “likes” is only one of the many forms of pleasures that the Social Networks provide. There are also several other possible ways in which pleasure is conveyed through social networks. This raised the term Social network addiction (Wang, 2013).

Finally, some studies have been completed to try to ascertain the prevalence of substance and behavioral addictions and the co-occurrence of two or more addictions. For example, Sussman et al. (2011) examined data from 83 studies with sample sizes of at least 500 to 11 addictive behaviors (including nicotine dependence and internet addiction) over a 12-month period. They found that the 12-month prevalence of these 11 addictions among U.S. adults averaged 47% of the population, with a 23% co-occurrence (of two or more addictions). They suggested that addictions are sharing a similar neurobiological vulnerability.

RATIONALE OF THE STUDY

Recently, behavioral addictions in general and internet addiction in particular have remarkable consequences in the society and have been presented frequently in psychiatric outpatient clinics. However they are not clearly and comprehensively included in current diagnostic models. Since, it is supposed that different types of addictions are sharing a similar neurobiological vulnerability; it would be beneficial to study and describe the problem of internet addiction and internet gaming disorder through a scientific approach and try to find a correlation with nicotine dependence.