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Occurrence of problematic Internet use and its correlates among Egyptian adolescent students in international schools in Cairo

Reem El Fiky^{1,2*} , Mona Mansour², Mohamed Fekry², Mahmoud ElHabiby², Hussien Elkholy²  and Mahmoud Morsy² 

Abstract

Background: Internet addiction is a global phenomenon that has been a topic of great interest to researchers, clinicians, teachers, parents, and community groups. The study aims in determination of the rate of problematic Internet use among a sample of Egyptian adolescent students, relations of problematic Internet use with socio-demographic data, risk factors, and comorbid psychiatric disorders. A sample of 248 Egyptian adolescent school students aged 11 to 18 years old were assessed using the Young's Internet Addiction Test (IAT), Internet Gaming Disorder (IGD) Scale, Social Media Disorder (SMD) Scale, Youth Self-Report (YSR), and The Mini International Neuropsychiatric Interview for children and adolescents (Mini KID).

Results: Among the study sample, 42.3% of the students suffered from mild Internet addiction, 35.1% suffered from moderate Internet addiction, and 3.6% suffered from severe addiction. 31.5% were risky gamers and 10.5% were disordered gamers; 34.3% had problematic social media disorder and the highest observed psychiatric disorders were major depressive episodes 9.3%, generalized anxiety disorder 7.7%, alcohol dependence 4.4%, attention-deficit hyperactivity disorder 4.4%, social phobia 4%, and a higher percentage of psychiatric disorders among severe Internet addiction 88.9% and among moderate addiction 70.6%, disordered gamers 92.3%, problematic social media users 60%, and a higher mean of hours spent online per day of 6.8 h per day.

Conclusions: Problematic Internet use has a negative impact on Egyptian adolescent students in international schools in study sample and adds to the existing literature regarding the magnitude of Internet addiction and its relationship with different psychiatric disorders.

Keywords: Internet addiction, Internet gaming disorder, Social media disorder, Adolescents, Comorbid psychiatric disorders, Egypt

Background

Since the early 2000s, studies indicating the existence of problematic Internet use and gaming addiction have been increasing in number drastically [1]. While Internet addiction disorder (IAD) is still not included in the

latest DSM manual [DSM-5] [2], Internet Gaming Disorder (IGD) is listed in Section III, Conditions for Further Study as a disorder requiring further study [3]. Social networks addiction is another type that has been widely observed among children, adolescents, and adults [4]. Cash et al. [5] reported variance of prevalence rates for IAD between countries (from 0.3 to 38%). While US and European rates vary between 1.5 and 8.2%, others reported the rates between 6 and 18.5%. Variance according to gender difference in prevalence rates reported was 7.7% in boys and 3.8 % in girls in a study in Korea

*Correspondence: dr.reemfiky@gmail.com

² Institute of Psychiatry, Faculty of Medicine, Ain Shams University, 38 Abbassia Square, Next to Al-Nour Mosque, Cairo 11591, Egypt
Full list of author information is available at the end of the article

while the most used service in boys was Internet gaming (58.1%) and girls used social media via blogging (22.1%) and chatting (20.3%) [6]. Internet addiction is associated with various risk factors [7] including sociodemographic variables (e.g., male gender, younger age, and higher family income), Internet use variables (e.g., time spent online, using social and gaming applications), psychosocial factors (including impulsivity, neuroticism, and loneliness), and comorbid symptoms (e.g., depression, anxiety, and psychopathology in general). The IGD prevalence ranged from 1.2 % [8] to 9.2 % [9].

The negative impacts of IAD and IGD were identified by Cash et al. [5, 10] that it may ruin lives by causing neurological complications, psychological disturbances, and social problems and also [11] specifying affected academic/ job achievement, sleep duration, leisure activities, time spent gaming, and money spent on gaming. Various treatment options for IAD exist like psychological [motivational interviewing (MI), reality therapy (RT), acceptance and commitment therapy (ACT), cognitive-behavioural therapy (CBT) for individual or group applications] and non-psychological [sport exercise, electro acupuncture, and pharmacological as naltrexone opioid receptor antagonist, quetiapine antipsychotic, selective serotonin-reuptake inhibitors and bupropion antidepressants, mood stabilizers, and methylphenidate psycho-stimulant] [10]. Total abstinence from the Internet should not be the goal of the interventions and that instead, an abstinence from problematic applications and a controlled and balanced Internet usage should be achieved [12].

Egypt's young population the adolescents (aged 10–19) are around 17 million, representing approximately 19% of the total population [13]. The current study aims to assess Internet, gaming, and social media addiction in a sample of Egyptian adolescent students determining relations of problematic Internet use with socio-demographic data, risk factors, and comorbid psychiatric disorders among adolescents who are considered as the most vulnerable group to the temptations of the Internet because they have poorer self-control, worse self-regulation, and poorer cognition than adults. In contrast, in our time, computer use by adolescents is promoted and, in some courses, is required [14].

Significant neurodevelopmental changes occur during adolescence in prefrontal cortex and cortico-striatal circuitry suggesting involvement in impulse control disorders [15]. Therefore, this immaturity may affect decision-making and learning drive with disruptions in the two contributing neurotransmitters dopamine and serotonin [16].

Nationally, in Egypt, more than 80% of Internet Café clients were described to be young individuals [17].

Extreme use of smart phones and Internet addiction frequently start off during late childhood and adolescence. IA establishes several psychological, social, school, and work problems and obstacles in a person's life especially for adolescents that is why it is important to study Internet addiction in adolescents since a few studies assessed IA among high school students. Other studies conducted in other countries proposed that younger age groups became more engaged in Internet-related activities, which requires evaluating IA among these age groups in Egypt [18].

Methods

This study included 248 adolescent school students aged 11–18 years old of both genders who were recruited voluntarily from May 2019 to August 2021 participating from International Schools in Cairo, Egypt, to guarantee availability and accessibility of Internet services and use, also because these two schools allowed psychiatric interview for their students and gave their approval to perform the study which was not easy to get from other schools. Also, most of the available studies in Egypt addressed university students, for example two recent studies were performed by Abd El-Mawgood et al. [18] in four public secondary schools in Sohag and by Khalil et al. [17] in Greater Cairo governorate including 584 Egyptian adolescent high school students.

- *Sampling method:* convenient sampling by examining students who fit the criteria.
- *Inclusion criteria:*

1. Age: 11–18 years old
2. Gender: both sexes
3. Place of residence: Greater Cairo
4. Egyptian students who are able to understand and fulfill the self-administered questionnaires. Schools where English is the medium of instruction will be targeted to ensure availability and accessibility to the Internet.
5. Subjects agreeing and caregivers consenting to participate in the study.

- *Exclusion criteria:*

1. Presence of visible disabling physical or medical conditions
2. Non-consenting caregivers or subjects refusing to participate

- *Study procedures were performed in the following order:*

- 1- First, written consents were obtained from caregivers and adolescent students. Participating students were selected from school classes according to inclusion criteria by choosing a whole class and distributing the questionnaires to the students who agreed to join the study.
- 2- A pilot study was performed first in 2019 on a few Egyptian adolescent students in the same two International School in Egypt; they were given both Arabic and English versions of Internet Addiction Test and Internet Gaming Disorder Tests as trial and accordingly English versions of the first four self-reported questionnaire were chosen to be handed to them which was easier for them to read and understand because they practice English as a second language more in School, while The Mini kid psychiatric interview was used with both English and Arabic versions because for some of them speaking in their native language was better in expressing their symptoms.
- 3- Obtaining socio-demographic data and administration of 4 questionnaires: Young's Internet Addiction Test (IAT), Internet Gaming Disorder (IGD) Scale, Social Media Disorder (SMD) Scale, and Youth Self-Report (YSR) to all the participants. Application in class during their break time.
- 4- Then on the next day they were interviewed by the researcher to complete The Mini International Neuropsychiatric Interview for children and adolescents (Mini KID) assessment.

Young's Internet Addiction Test (IAT) (English version) [19]

It is a 20-item self-administered scale that measures the presence and severity of Internet dependency, compulsivity, escapism, dependency, and problems related to addictive use in personal, occupational, and social functioning. IAT is a Likert-scale ranging from 0 = less extreme behavior to 5 = most extreme behavior for each item. The severity impairment index is as follows: none: 0–30, mild: 31–49, moderate: 50–79, and severe: 80–100 points.

Internet Gaming Disorder (IGD) Scale (English version) [20]

The IGD scale is a short self-administered psychometric tool adapted from the nine core criteria that define IGD according to the DSM-5, to assess the severity of IGD and effects over a 12-month period. The participants are

divided into 3 groups: normal gamers: 0–2, risky gamers: 3–5, and disordered gamers: from 6 to 9 points.

Social Media Disorder (SMD) Scale (English version) [21]

This scale is a 27-item yes or no questionnaire; three items were created for each of the nine criteria: Preoccupation, Tolerance, Withdrawal, Displacement, Escape, Problems, Deception, Displacement, and Conflict. The cut-off point: 5 or more symptoms are regarded problematic social media use.

Youth Self-Report (YSR) (English version) [22]

The current edition of YSR is a structured clinician-rated interview, normed for youth aged 11 to 18. It is a 112-problem item questionnaire that is completed by youths. It is used to examine behavioral profiles into eight subscales which are categorized as internalizing subscales (anxious/depressed, withdrawn, and somatic complaints), externalizing subscales (rule-breaking behavior and aggressive behavior), and other subscales (social problems, thought problems, and attention problems). The scores were considered on normal, borderline, and clinical ranges.

The Mini International Neuropsychiatric Interview for children and adolescents (Mini KID) (English version [23] and Arabic Version [24])

Both English and Arabic versions were used because for some of these Egyptian students speaking in their native Arabic Egyptian language was better in expressing their symptoms but for others, they practice English language more in school.

Statistical analysis

Descriptive statistics for the total sample were performed. Quantitative and qualitative measurements were summarized as mean \pm standard deviation and n (%), respectively. We performed comparisons of continuous and categorical variables by using chi-square and T -test. Pearson correlation coefficient, Spearman correlation coefficient, and linear regression were used to evaluate the association among the different variables. Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 22 for Windows. A p -value less than 0.05 was considered statistically significant.

Ethical considerations

The study was approved by Ain Shams University Faculty of Medicine Research and Ethical Committee (REC) FWA 000017585 FMASU M D 82 / 2019 and the scientific committee of the department of Neurology and Psychiatry. All the needed approvals were fulfilled. Also, written consents were obtained from caregivers and adolescent

students after explaining the procedure and the right to withdraw from the study at any time. Their information were obtained by meeting the main researcher in their classes and the collected surveys with their contact information on their questionnaire forms that were kept in a safe place accessible only by the main researcher and no hazards to the students or their caregivers.

Results

The current study shows that total number of students participating during the period of 2019 to 2021 is 248 adolescents. There were 114 male students (46 %) and 134 female students (54%).

The number of students participating in this study during the year 2019 was 63 (25.4 %) before COVID-19 pandemic, during the year 2020 was 125 (50.4 %) and during the year 2021 was 60 (24.2 %) after COVID-19 pandemic with average age of all students participating 14.9 years old with an average 5.04 h spent online per day. This study also shows that 42.3% of the students suffered from mild Internet addiction and 35.1% moderate Internet addiction, and 31.5% were risky gamers and 34.3% had problematic social media disorder as shown in Table 1.

Moreover, regarding the comorbid psychiatric disorders, the highest observed psychiatric disorders were major depressive episodes 9.3%, generalized anxiety disorder 7.7%, alcohol dependence 4.4%, attention-deficit hyperactivity disorder 4.4%, social phobia 4%, and a higher percentage of psychiatric disorders among severe Internet addiction 88.9% and moderate addiction 70.6%, disordered gamers 92.3%, problematic social media users 60%, and a higher mean of hours spent online per day of 6.8 h daily as shown in Tables 2 and 3. According to Table 4, 92 students (37.1%) had psychiatric disorders in which 60 students (24.4%) had one psychiatric disorder

Table 2 Distribution of the results of Mini-kid psychiatric disorders among disordered individuals in the study sample

N=248	Disordered No. (%)
Major depressive episodes	23 (9.3)
Dysthymia	8 (3.2)
Suicidality	3 (1.2)
Hypo manic episode	4 (1.6)
Panic disorder	6 (2.4)
Separation anxiety	1 (0.4)
Social phobia	10 (4.0)
Obsessive compulsive disorder	4 (1.6)
Generalized anxiety disorder	19 (7.7)
Alcohol dependence	11 (4.4)
Drug dependence	7 (2.8)
Tic disorder	3 (1.2)
Attention deficit Hyperactivity disorder	11 (4.4)
Conduct disorder	2 (0.8)
Oppositional defiant disorder	5 (2.0)
Anorexia nervosa	2 (0.8)
Bulimia nervosa	2 (0.8)
Psychotic disorders	1 (0.4)
Post-traumatic stress disorder	5 (2.0)
Adjustment disorder	3 (1.2)

and 10.5% had two psychiatric disorders. Therefore, individuals with more than one psychiatric disorder or comorbidities are 32 students (12.9 %).

Comparison between the mean of hours spent online per day and Mini-kid psychiatric disorders according to ICD-11 shows that a higher mean of hours spent online per day among cases with mood disorders 7 h, with anxiety disorders 7.3 h, with substance use disorders 7 h, and with ADHD 7.2 h as shown in Table 5.

Correlation data shows a highly significantly positive correlation between Internet addiction severity and grades of internet gaming disorder $R=0.502$, $P=0.000$, and problematic social media disorder $R=0.508$, $P=0.000$, and shows a highly significantly positive correlation between grades of Internet addiction severity and the number of Mini Kid psychiatric disorders $R=0.574$, $P=0.000$, using the Spearman correlation coefficient. Finally, the linear regression model for prediction of the score of Internet addiction test statistically significantly predicts the outcome variable as shown in Table 6.

Table 1 Distribution of the Internet Addiction Test, Internet gaming disorder, and social media disorder among adolescents

N=248	No.	%
Internet Addiction Test		
None	47	19
Mild	105	42.3
Moderate	87	35.1
Severe	9	3.6
Internet gaming disorder		
Normal	144	58.1
Risky gamer	78	31.5
Disordered gamer	26	10.5
Social media disorder		
Non-problematic	163	65.7
Problematic	85	34.3

Discussion

The current study aims to determine an outline for problematic Internet use in adolescents, its effect on their functionality and family, the factors and variables for assessing severity of Internet addiction, the average hours spent online using the Internet technology on different

Table 3 Comparison between severity of Internet addiction, Internet gaming disorder, Social media disorder, hours spent online per day, and presence of psychiatric disorders by Mini-kid

Variables	Mini-Kid psychiatric disorders			
	Negative	Positive	X2	P
Internet addiction Test (IAT)				
None, N=47 No. (%)	45 (95.7)	2 (4.3)	85.8	0.000**
Mild, N=105 No. (%)	84 (80.0)	21 (20.0)		
Moderate, N=87 No. (%)	26 (29.9)	61 (70.6)		
Severe, N=9 No. (%)	1 (11.1)	8 (88.9)		
Internet gaming disorder (IGD)	Negative	Positive	52.4	0.000**
Normal, N=144 No. (%)	113 (78.5)	31 (21.5)		
Risky gamer, N=78 No. (%)	41 (52.6)	37 (47.4)		
Disordered gamer, N=26 No. (%)	2 (7.7)	24 (92.3)		
Social media disorder (SMD)	Negative	Positive	29.0	0.000**
Non problematic, N=163 No. (%)	122 (74.8)	41 (25.2)		
Problematic, N=85 No. (%)	34 (40.0)	51 (60.0)		
Hours spent online per day	Negative N=156	Positive N= 92	t	P
Mean	3.9	6.8	9.1	0.000**
SD	2.0	2.7		

**P<0.001 highly significant

Positive, diagnosed with one or more psychiatric disorders

Table 4 Distribution of the results of Mini-kid psychiatric disorders among the study sample

N=248	Mini Kid Psychiatric disorders	
	No.	%
None	156	62.9
Disordered total	92	37.1
One disorder	60	24.2
Two disorders	26	10.5
Three disorders	5	2.0
Four disorders	1	0.4

platforms, and the psychiatric symptoms and disorders that should be monitored and managed by psychiatrists and parents to raise awareness to this important issue focusing on beneficial use of Internet nationally and internationally.

In this study sample with 248 adolescents, the average number of hours spent online per day is 5.04 h and in year 2019 was 5.0 h per day, in year 2020 was 4.9 h per day, and in year 2021 was 5.1 h per day.

Table 5 Comparison between the mean hours spent online per day and Mini-Kid psychiatric disorders according to ICD 11

Mini-Kid Psychiatric Disorders ICD 11	Hours spent online per day		
	Mean (SD)	t	P
Mood disorders			
Negative, N=218	4.7 (2.6)	4.4	0.000**
Positive, N=30	7.0 (2.4)		
Anxiety disorders			
Negative, N=216	4.7 (2.4)	5.3	0.000**
Positive, N=32	7.3 (3.2)		
Substance use disorders			
Negative, N=237	4.9 (2.7)	2.4	0.01*
Positive, N=11	7.0 (2.7)		
ADHD			
Negative, N=237	4.9 (2.7)	2.8	0.005**
Positive, N=11	7.2 (2.5)		

*P<0.05 significant; **P<0.01 highly significant

In the current study, Internet addiction severity shows that severe Internet addiction is 3.6 % in 9 adolescents, moderate Internet addiction is 35.1 % in 87

Table 6 Linear regression model for prediction of the score of internet addiction test: Internet Addiction Test score

	<i>B</i>	<i>t</i>	<i>P</i>
Constant	20.021		
Age	0.026	0.04	0.9
Hours online per day	4.779	15.5	0.000**
Gender	3.550	2.1	0.03*

* $P < 0.05$ significant; ** $P < 0.01$ highly significant

The final model for Internet Addiction Test score: = $20.021 + [\text{age} \times 0.026] + [\text{hours online per day} \times 4.779] + [\text{gender} \times 3.55]$

adolescents, mild Internet addiction is 42.3 % in 105 adolescents, and non-Internet addiction is 19% in 47 adolescents. This study's results agree with other Egyptian studies, first study on 584 Egyptian adolescents in Greater Cairo governorate including high school students aged 14 to 18 years old using the same Young's Internet Addiction Test showed that 201 students (34.4%) were normal Internet users, 191 students (32.7%) had mild dependence, and 170 (29.1%) were moderately dependent and only 22 students were severely dependent (3.8%) [17], the prevalence of IA among 17 to 25 years old medical students in Sohag University (47.7%) because male sex, availability of Internet access on mobile phones, easy Internet access at home, browsing social media and e-mail, and bad family relations were the most important predictors of IA in that study [25]. Moreover, the co-existing study results were like a study performed using the same Young's Internet Addiction Test in China by Tang et al. [26] who reported that adolescents aged 11 to 20 years old with Internet addiction were 509 (3.3%) scored 70 or higher, with possible IA were 4670 (29.9%) scored 40 to 69, and the ones with non-Internet addiction were 10,444 (66.9%) scored 39 or lower.

On the other hand, the current study results were higher than an Egyptian study performed on 400 high school adolescent students aged 15 to 17 years old in four public secondary schools in Sohag in Egypt using Young's Internet Addiction Test showing that 34.8% were mild Internet addicts, 21% were moderate Internet addicts, and 4% were severe Internet addicts [18], and are higher than results of Nafee et al. [27], who assessed IA among teenagers in Saudi Arabia and in Egypt and found that 47.7%, 45.3%, and 0.9% of the Saudi teenagers were mild, moderate, and severe Internet addicts compared to 44.2%, 46.3%, and 0.3% of the Egyptian teenagers. Moreover, Restrepo et al. [28] performed a study in the USA on 564 participants aged 7 to 15 years old using Young's Internet Addiction Test for assessing problematic Internet use present in 124 participants

(21.99%). A different assessment scale was used in a study in Korea by Kim et al. [6] who used the Internet Addiction Proneness Scale for Youth short form (KS scale) on 223,542 adolescents aged 12 to 18 years with overall prevalence of PIU 5.8% (13056 participants). These variations in numbers can be explained by using different assessment scales and different accessibility to participants and to the Internet.

This study shows that using the Internet Gaming disorder scale, disordered gamers are 10.5 % (26 adolescents), risky gamers are 31.5 % (78 adolescents), and normal gamers were 58.1% (144 adolescents) which was increasing because adolescents in this stage are competitive and influenced by peer pressure to try new challenges whether in single player games or multi-player games. Another study on 584 Egyptian adolescent high school students aged 14 to 18 years old using the same Lemmens's Internet Gaming disorder scale showed that 38.7% are normal gamers and 37.3% are risky gamers, while nearly 24% are disordered gamers explaining the frequencies of both risky and disordered gamers are much higher among Egyptian students which can be attributed to the deficient interactive activities away from the virtual online life that made online gaming the most suitable and convenient way to spend the leisure time [17]. Similar results were observed In Lebanon, Hawi et al. [2] studied using Internet Gaming Disorder Test (IGD-20 test, 5-point Likert scale) in 2096 high school students aged 15 to 19 years old with prevalence of IGD 9.2 %, risky gamers 35.7%, and casual gamers 55.1% with an average daily playtime of gamers 2.2 h and the maximum number of hours gaming online doubled to increase from 7 h daily on weekdays to 14 h daily on weekends.

However, Rajab et al. [29] studied in Saudi adolescents aged 10 to 19 years using 7-item Gaming Addiction Likert scale (GAS) with lower prevalence of gaming addiction 5.1 % (130 participants out of 2537 adolescents) and 68.5% used more than 3 hours daily screen time (89 adolescents). The proportion of Internet gaming users among those with PIU was the highest as 56.0% [6]. The reasons behind this wide variation of reported prevalence of gaming addiction among the studies could be explained by dissimilar assessment scales, the diverse conceptualizations of gaming disorder, the non-standardized scales used to assess gaming disorder, the use of different methods to estimate the prevalence of gaming disorder, differences in sample characteristics, and the effect of COVID-19 pandemic regarding sampling procedures, setting, and time frame of data collection.

Regarding social media use, the existing study showed that prevalence of problematic social media disorder use was 34.3 % in 85 adolescents out of total 248 participants using Social Media Disorder scale. Using the same scale,

results studied by Boer et al. [30] in 11-, 13-, and 15-year-olds were higher than our study results which stated the prevalence of social media use in adolescents in 29 countries. Intense SMU was in Italy 49.87%, Belgium 43.29%, Poland 43.25%, Sweden 43.10%, Lithuania 40.90%, and Portugal 40.36%. Intense users may be overly subjected to idealistic portrayals of others, which, in sequence, may elicit social comparisons decreasing their mental well-being and may be a common behavior among adolescents as social media is often engaged in their daily social lives.

On the other hand, there were lower prevalence rates of SMD reported in [31] study using the Social Media scale assessed among a total of 2198 Dutch adolescents aged 10 to 17 years, divided in 3 samples who met cut off point 5 or more points was 7.3 % (53 out of 724 adolescents) in the first sample, was 11.6 % (101 out of 873 adolescents) in second sample, and was 10.3% (62 out of 601 adolescents) in third sample. This variance in the current study could be explained by the association with different types of social media applications and adolescents' well-being with inconsistent social support, decreased social activities during COVID-19 pandemic, and spending less offline time with friends or family because of their compulsive need to receive immediate gratification from using different social media platforms.

Regarding comorbid psychiatric disorders, this study shows using the Mini-kid Psychiatric Interview questionnaire that the prevalence of the highest observed psychiatric disorders were major depressive episodes 9.3% followed by generalized anxiety disorder 7.7%, alcohol dependence 4.4%, attention-deficit hyperactivity disorder 4.4%, social phobia 4%, and dysthymia 3.2%. Also in the comparison of the presence of psychiatric disorders and severity of Internet addiction, Internet gaming disorder, social media disorder, and the mean of hours spent online per day, this study shows a higher percentage of psychiatric disorders among severe Internet addiction 88.9% and among moderate addiction 70.6%, disordered gamers 92.3%, problematic social media users 60%, and a higher mean of hours spent online per day of 6.8 hours per day. Accordingly, 92 students (37.1%) had psychiatric disorders in which 60 students (24.4%) had one psychiatric disorder and 10.5% had two psychiatric disorders. Therefore, Individuals with more than one psychiatric disorder or comorbidities are 32 students (12.9 %). These findings are explained by the changes in the dopamine and serotonin neurotransmitters biologically and the cognitive behavioral model that happens in this crucial developmental stage leading to anxiety and depression, difficulty maintaining attention, social skills deterioration, and developing other substance or behavioral addictions due to disturbance in reward center and the need for immediate sense of pleasure.

Similarly another study on 584 Egyptian adolescent high school students aged 14 to 18 years old, among 383 adolescents suffered from Internet addiction, 86 had depression (22.5%), 96 had severe suicidality (25.1%), 93 had dysthymia (24.3%), 73 had panic disorder (19.1%), 98 had social anxiety (25.6%), separation anxiety was present in 106 adolescents (27.7%), and phobia disorder was present in 52 adolescents (13.6%), and among 358 adolescents who suffered from Internet game addiction, 84 had depression (23.5%), 94 had severe suicidality (26.3%), 67 had panic disorder (18.7%), 98 had social anxiety (27.4%), 83 had separation anxiety (23.2%), and 57 had phobia disorder (15.9%) [17].

In Duan et al.'s [32] study in China during COVID-19 pandemic, their findings were higher than ours, using the Child Depression Inventory (CDI), 22.28% respondents (805 individuals) were suffering from the clinical depressive symptoms and Internet addiction was present in 61.01% of the depressed participants (133 individuals). Similarly, Kim et al. [6] reported that the proportion of participants who experienced a depressive episode, suicidal ideation, and suicidal attempt were 38.0%, 19.1%, and 4.8%, respectively, while suicidality in our study is assessed to be 1.2%. Another study performed in Egypt on Sohag University, 588 students showed that 86.9% of students with PIU had anxiety and 85.02% of students with PIU significantly had depression; this could be explained by the academic overload and the high pressure of study demands that these university students are facing [33].

This finding in the current study regarding comparison between the mean of hours spent online per day and Mini-kid psychiatric disorders according to ICD-11 shows that a higher mean of hours spent online per day among cases with mood disorders 7 h, with anxiety disorders 7.3 h, with substance use disorders 7 h, and with ADHD 7.2 h. Rajab et al. [29] also stated that the prevalence of high stress was 11.4% in Saudi adolescents with gaming addiction, adolescents who spent more than 3 h per day had 75.1% high stress, 2 to 3 h per day had 10.7 % high stress, 1 to 2 h per day had 9.0% high stress, and less than 1 h per day had 5.2% high stress. Game-addicted individuals were more likely to be younger, male than female, and also more likely to come from a broken family than from an intact family. The proportion of participants with unhealthy dietary habits, an inactive lifestyle, and greater screen time (>3 h/day) was significantly higher in the high-stress group than their corresponding proportions in the low-stress group.

The COVID-19 pandemic increased the use of Internet for both leisure activities and academic activities so due to the occurrence of COVID-19 during our data collection process the effect of COVID-19 pandemic

was studied. The results regarding effect of COVID-19 on the study sample, leading to a higher prevalence of moderate Internet addiction in students examined after COVID-19 pandemic 37.3% and of severe addiction after pandemic 4.3%, while in comparison with Youth Self Report, show a higher percentage of externalizing sub-scale behavioral traits among student after pandemic 13% and affected YSR Competencies leading to a higher percentage in extracurricular activities, social performance, and school performance among students after COVID-19 pandemic 38.9 %, 28.6%, and 30.3% respectively. A comparison of the difference in the Mini Kid psychiatric disorders shows increase in number of overall cases 74 students (40%) after COVID-19 pandemic compared to 18 students (28.6%) before COVID-19 pandemic. But strangely, in comparison of the mean hours spent online there was no significant difference statistically in this study unlike expected difference that was observed in other studies like Duan et al. [32] observed in China an increase in average time per day spent on Internet before and during COVID-19 epidemic stating that adolescents spending 3–5 h daily after pandemic were higher 996 (27.57%) compared to before pandemic 566 (15.67%) and those spending more than 5 h daily after pandemic were higher 1069 (29.58%) compared to before pandemic 366 (10.12%).

Two studies measured hours spent online during the COVID-19 pandemic; the first report performed in China by Sun et al. [34] reported that during the pandemic, 46.8% of subjects stated increased dependence on Internet use (47.6% for males and 46.1% for females) and 16.6 % had longer hours of Internet use (18.8% for males and 14.5% for females) and severe Internet dependence rose up to 23%. In the second study applied in China, 23% of addicted Internet users and 8.3 % of non-addicted users spent more than 28 h online every week and the more hours spent online, the higher rates of AIA. Of all 449 (8.8%) addicted Internet users 31.8% spent more than 8 h online on each weekend (Saturday or Sunday), while only 10.5% did it in a weekday. These results are expected since adolescents have loads of leisure time on weekends, lack of supervision, and are mentally immature leading to this “weekend” effect. The anxiety levels of children and adolescents were (23.87 ± 15.79) and (29.27 ± 19.79), respectively. 22.28% respondents were suffering from depressive symptoms. Also this study showed that children and adolescents who experienced disasters might suffer from greater stress and trauma because of the lack of development of proper emotional reactions and coping techniques leading to unmet needs caused by home confinement, deferred back-to-school, and lifestyle changes [14].

These differences in relation to our study results can be explained by the fact that our data collection was done in 3 timings first in year 2019, 63 students participated (25.4%) before the pandemic which was not enough to compare to the year 2020 in which 125 students participated (50.4%) but we could not reach them during the lockdown and peak of the COVID-19 pandemic in Egypt which was the period of March 2021 to June 2021, and also another part of the sample collection 60 students (24.2%) were taken during the year 2021 after the peak of the pandemic too.

Furthermore, correlation data shows a highly significantly positive correlation between Internet addiction severity and grades of Internet gaming disorder and problematic social media disorder and shows a highly significantly positive correlation between grades of Internet addiction severity and the number of Mini-Kid psychiatric disorders using spearman correlation coefficient.

Lastly, in the linear regression model for prediction of the score of Internet addiction test, the number of hours spent online per day is an independent significant variable predictor with the score of the Internet addiction test (with all the remaining variable constant). Here, $p < 0.0001$, which is less than 0.05, and indicates that, overall, the regression model statistically significantly predicts the outcome variable.

Conclusions

To sum up, all these previously mentioned findings in this study postulate that problematic Internet use has a negative impact on Egyptian adolescent students in international schools in the study sample regarding their psychological and physical wellbeing, which adds to the existing literature regarding the magnitude of Internet addiction and its relationship with different psychiatric disorders and contribution in a concept for diagnostic criteria for Internet addiction. Accordingly, that resulted in a higher percentage of positive psychiatric disorders among individuals with Internet addiction and a higher mean of hours spent online per day.

Limitations

First, obtaining approvals to perform studies in international schools was not easy. The researcher was able to only secure surveys from two schools in Greater Cairo; hence, results cannot be generalized. Second, due to the unexpected COVID-19 epidemic situation causing delay and difficulty in data collection therefore, its impact could not be excluded, and the researcher could not reach the students during Lockdown peak usage time which was March 2020 to June 2020 that increased the leisure online time then many schools resorted to online teaching which might have increased the online time for studying purposes.

Abbreviations

DSM-5: 5th edition of the Diagnostic and Statistical manual of Mental Disorders; ICD-11: 11th edition of the International Classification of Diseases; IA: Internet addiction; AIA: Adolescent Internet addiction; PIU: Problematic Internet use; IAT: Internet Addiction Test; IGD: Internet gaming disorder; SMD: Social media disorder; SMU: Social media use; YSR: Youth Self-Report; MINI-KID: The Mini International Neuropsychiatric Interview for children and adolescents; COVID-19: Coronavirus disease 2019; ADHD: Attention-deficit hyperactivity disorder.

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Authors' contributions

MM and MF hypothesized the concept for the research and supervised the final analysis of the results obtained. MM, HK, and MH supervised the data analysis and supervised writing the manuscript. RF made the data collection, interpreted the analyzed data, and was a major contributor in writing the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Declarations

Ethics approval and consent to participate

The study was approved by Ain Shams University Faculty of Medicine Research and Ethical Committee (REC) FWA 000017585 FMASU M D 82 / 2019 and the scientific committee of the Department of Neurology and Psychiatry. All the needed approvals were fulfilled. Also, written consents were obtained from caregivers and adolescent students after explaining the procedure and the right to withdraw from the study at any time. Their information was kept in a safe place accessible only by the main researcher. The consent also included publishing the results of the study with keeping the anonymity of both cases and their caregivers.

Consent for publication

The participants gave consent for using their data in publication.

Competing interests

The authors declare no competing interests.

Author details

¹Faculty of Postgraduate Childhood Studies, Ain Shams university, Cairo, Egypt.

²Institute of Psychiatry, Faculty of Medicine, Ain Shams University, 38 Abbassia Square, Next to Al-Nour Mosque, Cairo 11591, Egypt.

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