

Prevalence and Determinants of Internet Addiction among adults during The covid-19 Pandemic in Makkah, Saudi Arabia: An Online Cross-Sectional Study

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Abstract: Background: Internationally, internet use has increased expressively during the COVID-19 pandemic, and internet addiction (IA) has turned out to be a severe public health issue. Consequently, this study aimed to assess IA prevalence among adults and identify its determinants during the COVID-19 pandemic in Makkah region. Methods: Using a cross-sectional design, this study recruited 608 participants through a self-administered online based e-questionnaire. Young's internet addiction test (YIAT) of 20 items was used to assess the prevalence of IA among adults. Results: The overall prevalence of IA was 29.4% among adults during the COVID-19 pandemic. However, the addiction rate was 34.7% among participants under 20 years old. Spending more time on the internet during the COVID-19 pandemic (AOR=2.06, 95% CI 1.08–3.94) were likely the reasons for IA among Makkah adults. Participants aged over 24 years (AOR= 0.39, 95% CI 0.17–0.91), living away from family (AOR= 0.45, 95% CI 0.26–0.79), committed to physical activity (AOR=0.35, 95% CI 0.24–0.52), and sleeping less than or equal 6 hours (AOR=0.63, 95% CI 0.42–0.93) had a lower chance of IA during the COVID-19 pandemic. Conclusion: This study has shown that the prevalence of IA was comparatively higher among

younger participants during the COVID-19 pandemic. Long-time use of the internet, physical activity status, and sleeping duration were the most significant determinants of IA. Thus, raising awareness among the younger generation is the most important strategy to lessen IA. The findings of this study can be used to support health and educational organizations to design their programs, which will help prevent IA in Makkah during the COVID-19 pandemic.

Introduction:

Internet addiction (IA) denotes to an unhealthy and poorly regulated preoccupation with the internet resulting in impulsive behaviors and psychiatric impairments (**Shaw and Black, 2008**). The concept of IA was brought to light by **Griffiths (1996)**; however, **Young (1998)** successfully characterized IA as an ‘impulse-control disorder’ free of intoxication. Due to the realization of the potential adverse impacts, it can have on the behavioral and functional aspects of an individual; IA has been included as a non-substance addictive disorder in the DSM-5 (**American Psychiatric Association, 2013**). IA may cause difficulties in personal and social life, and its harmful effects may include compulsive behavior, poor sleep quality, reduced food consumption, attention deficit, resistance towards family and academic obligations and decreased academic grades, as well as psychological problems, such as depression and anxiety (**Diomidous et al., 2016; Alam et al., 2014; American Psychiatric Association, 2013; Bener et al., 2019**).

Despite posing a substantial threat to significant life domains, including interpersonal and intrapersonal relations and physical and mental health (**Alam et al., 2014; Young, 1998**), reliance on the internet has been increasing worldwide at a dramatic rate. For instance, a meta-analysis comprising 164 studies (N = 89.281) from seven world regions estimated a global prevalence of 6% for IA, with the highest prevalence reported in the Middle East (10.9%), followed by North America (8%) and Asia (7.1%) (**Cheng and Li, 2014**). Studies suggest that young men, primarily students from economically well-off families living in urban areas, who spend more hours on the internet for academic or non-academic purposes, are more susceptible to IA (**Afrin et al., 2017; Hassan et al., 2020**).

However, the world may have witnessed an unprecedented spike in IA due to the ongoing novel coronavirus disease of 2019 (COVID-19) pandemic, which originated in Wuhan, China (**Forster et al., 2020**). COVID-19 has an exceptionally high human-to-human transmission rate, thus, compelling the global public

health watchdog – the World Health Organization (WHO) – to declare a global pandemic on 11 March 2020 (**World Health Organization, 2020**). In the absence of specific antidotes or vaccines, it became a global challenge during 2020 for national and international public health agencies to curb the spread and loss of lives.

By April 2021, 140 million people were infected with COVID-19, and it had killed over three million people worldwide. Therefore, the global community implemented a wide range of non-therapeutic measures, including restricting the travel of foreign nationals, closing entire transit systems as well as public spaces, and shutting down educational institutions as well as more stringent steps like country-wide lockdowns (**Ahmed et al., 2020; Cao et al., 2020**). Prolonged ‘home confinement’ due to COVID-19 significantly affected the mental well-being of different cohorts of people, causing intensified anxiety, depression, stress, fear, worsening sleep quality, and increasing substance abuse (**Ahmed et al., 2021; Cao et al., 2020**).

Subsequently, people turned to the internet and other technology-based mechanisms to ‘alleviate negative feelings’ (**Kardefelt-Winther, 2014**) and cope with the ‘new normal’ by supporting their work, communication, and academic activities (**Ela et al., 2021**). Exposure to social and mass media through the internet allowed people to receive daily updates on the pandemic situation, which improved public awareness and encouraged ‘social distancing’ and ‘home staying’ (**Sakya et al., 2021**). However, the sense of loneliness during the prolonged lockdown (**Li et al., 2021**), together with COVID-19-related anxiety and depression, were significantly associated with overconsumption of the internet and smartphone use. This ‘over-exposure’ evidently led to growing anxiety and depression, particularly among the younger population (**Elhai et al., 2020; Hammad and Alqarni, 2021**).

Studies during the COVID-19 pandemic found heightened IA among people of different age cohorts worldwide and linked it with a wide range of factors. For example, study in Taiwan noted a 24.4% prevalence of IA among junior high school students; this was significantly associated with increased impulsivity and alexithymia, low subjective well-being, and family function, especially among older students (**Lin, 2020**).

In Saudi Arabia, a few studies addressed IA and related issues in the pre-COVID-19 period. Hence, this cross-sectional web-based study aimed to estimate the prevalence of IA among the adult population in Makkah and to identify the risk factors associated with it during the COVID-19 pandemic.

Materials and method:

This study was web-based and cross-sectional, the data were collected online over a period of around two month, starting on 1 December 2020 and ending on 31 January 2021. Face book was selected as the most suitable platform. As such, the participants were recruited randomly through existing social media – i.e., Facebook – and were invited to respond to a self-administered e-questionnaire developed using Google Form. The e-questionnaire contained three separate but interrelated modules, including questions on socio-demographic information, IA measurement, and information relating to the internet and other behavioral issues during the COVID-19 pandemic. The study set out the response range for maximum questions and encouraged the participants to answer intelligently through the e-questionnaire descriptions in order to ensure the survey's quality. This study considered only adults aged 18 years or above and recorded the participants' consent during the data collection. A total of 608 responses were recorded, all of which were retained in this study after week-long scrutiny. Ethical approval was obtained.

Socio-demographic and behavioral characteristics

Socio-demographic information including gender, age, occupational status, place of residence, educational qualification, and living arrangements (**Prakash et al., 2020; Hassan et al., 2020**) was collected. Furthermore, to ascertain fundamental behavioral factors, the survey included a few questions relating to lifestyle. The participants were asked if they were involved in physical activities such as exercise, walking, sports, cycling, or any other activities lasting at least 30 min per day (**Hassan et al., 2020**) during the COVID-19 pandemic. Participants were also asked to report their average, typical sleep duration during the ongoing pandemic as either short or long. They were then asked how long they spent online per day, the device they used to access the internet, duration of internet use, and status of internet use during the COVID-19 pandemic (**Mamun et al., 2019; Hassan et al., 2020**).

Internet addiction test

The IA of the participants was measured by Young's internet addiction test (YIAT) (**Young, 1998**). The YIAT – the most commonly and frequently used scale measuring the internet addiction of adults – comprises 20 items scored on a 5-point Likert scale ranging from 'not applicable' (0) to 'always' (5) with a maximum score of 100. Based on the scoring, participants were classified into 'not internet addicted' (0–59) and 'internet addicted' (60–100) (**Mamun et al., 2019**). The Cronbach's alpha (α) for YIAT in this study was 0.966,

reflecting an excellent internal consistency.

Statistical analysis

Descriptive analyses were conducted in order to describe the sociodemographic and behavioral characteristics of the participants. The prevalence of IA was stratified by age, gender, educational qualification, occupation, place of residence, physical activity status, sleep duration, the device of internet use, length of internet use, status of internet use during the COVID-19 pandemic, and daily internet use duration; Chi-square (χ^2) test was used to compare the differences between the groups at a 5% level of significance. Finally, considering the statistically significant factors from the Chi-square (χ^2) test, a multivariable binary logistic regression model was conducted in order to explore the potential determinants of IA. The results were shown using the adjusted odds ratio (AOR) with 95% confidence intervals (95% CI). The statistical package for the social sciences (SPSS) version 20 (SPSS Inc., Chicago, IL, USA) was used to organize and analyze the data.

Results:

Table 1 shows the characteristics of the participants. Of the 608 participants, 419 (68.9%) were male and 189 (31.1%) were female. Among the participants, 58.1% were aged 20–24 years, 78.8% were students, and three out of five participants (66.4%) had completed undergraduate or postgraduate education. Four out of five participants (79.3%) resided with their families, and 66.0% lived in urban areas during the pandemic. Around 80% of participants were non-smokers, and more than half were engaged in regular physical activities (54.9%) and slept less than or equal 6 hours a day (55.3%). Among the participants, 66.4% spent more than 3 hours per day on the internet, and 69.1% admitted that their internet use had increased during the pandemic.

Also, Table 1 also shows the prevalence (95% CI) of IA in relation to a range of socio-demographic and behavioral characteristics. The overall prevalence of IA was 29.4%. The findings indicate that participants with distinct characteristics, such as younger people, men, those without undergraduate education, students, those living in urban areas, those living with families, smokers, those who did not engage in any physical activity, and those sleeping more than 6 hours, were more likely to show IA. In addition, Table 1 also shows the association of IA with various explanatory factors using a Chi-square (χ^2) test of independence. The findings indicate that age ($p =$

0.007), education qualification ($p = 0.039$), place of residence ($p = 0.009$), living arrangement ($p = 0.001$), smoking status ($p = 0.001$), physical activity ($p < 0.001$), sleep duration ($p = 0.001$), status of internet use ($p = 0.001$), and duration of daily internet use ($p = 0.005$) were significantly associated with IA.

Age					
<20years	121 (19.9)	43(34.7)	79(65.3)	10.01	0.007
20–24years	353 (58.1)	112(31.7)	241(68.3)		
>24years	134 (22.0)	25(18.7)	109(81.3)		
Gender					
Female	189 (31.1)	46(24.3)	143(75.7)	3.44	0.645
Male	419 (68.9)	133(31.7)	286(68.3)		
Educationqualification					
BelowUndergraduate	204 (33.6)	71(34.8)	133(65.2)	4.25	0.039
Undergraduateand above	404 (66.4)	108(26.7)	296(73.3)		
Occupation					

Student	479 (78.8)	145(30.3)	334(69.7)	0.75	0.387
Job/Others	129 (21.2)	34(26.4)	95(73.6)		
Living arrangement during COVID-19					
Living with family	482 (79.3)	157(32.6)	325(67.4)	10.98	0.001
Living without family	126 (20.7)	22(17.5)	104(82.5)		
Physical activity status during COVID-19					
No	27(45.1)	115(42.0)	159(58.0)	37.6901	<0.0
Yes	334 (54.9)	64(19.2)	270(80.8)		
Sleep duration during COVID-19					
>6h	272 (44.7)	102(37.5)	170(62.5)	15.38	0.001
≤6h	336 (55.3)	77(22.6)	259(77.1)		
Device of internet used during COVID-19					
Mobile/Tab	353 (58.1)	107(30.3)	246(69.7)	0.32	0.853
Computer/Laptop	24(3.9)	7(29.2)	17(70.8)		

Both	231 (38.0)	65(28.1)	166(71.9)		
Internet use experience					
<2 years	82(13.5)	28(34.1)	54(65.9)	1.97	0.373
2–3 years	91(15.0)	30(33.0)	61(67.0)		
>3 years	435(71.5)	121(27.8)	314(72.2)		
Status of internet use during COVID-19					
Decrease	26(4.3)	2(7.7)	24(92.3)	15.78	0.001
Same	162(26.6)	34(21.0)	128(79.0)		
Increase	420(69.1)	143(34.0)	277(66.0)		
Daily internet use (Hour) during COVID-19					
≤3h	204(33.6)	45(22.1)	159(77.9)	8.05	0.005
>3h	404(66.4)	134(33.2)	270(66.8)		

Table II:

Significant factors from the Chi-square (χ^2) test of independence were retained in the multivariable binary logistic regression analysis in order to investigate how these factors have influenced IA in Bangladesh (Table 2). In the multivariable model, after complete

adjustments, there was robust evidence for the odds of IA being 1.88 times and 2.06 times higher among tobacco smokers (AOR = 1.88, 95% CI 1.15–3.07) and intensified internet users during the COVID-19 pandemic (AOR = 2.06, 95% CI 1.08–3.94). It is also evident that the odds of IA for older participants (>24 years) and those living in rural areas were 0.39 times (AOR = 0.39, 95% CI 0.17–0.91) and 0.51 times (AOR = 0.51, 95% CI 0.32–0.81) lower than for younger people and those living in urban areas, respectively. The odds of IA for participants living away from family were 0.45 times lower than for those living with family (AOR = 0.45, 95% CI 0.26–0.79). There was compelling evidence that the odds of IA were 65% lower among participants who were engaged in regular physical activities than among those who did not (AOR = 0.35, 95% CI 0.24–0.52). Participants who slept less than or equal 6 hours a day (AOR = 0.63, 95% CI 0.42–0.93) and those who had been exposed to internet use for over 3 years (AOR = 0.41, 95% CI 0.22–0.78) were less likely to be internet addicted than those who slept longer than 6 hours a day and those who had used the internet for less than two years, respectively.

Age	Coefficient β	Odds ratio, Exp (β)	lower 95% CI	upper 95% CI	p value
<20years ^{RC}		1.00			
20–24years	- 0.12	0.89	0.50	1.5 8	0.694
>24years	- 0.92	0.39	0.17	0.9 1	0.030
Gender					
Female ^{RC}		1.00			
Male	0.39	1.48	0.94	2.3 2	0.088
Education qualification					
Below Undergraduate ^{RC}		1.00			
Undergraduate and above	- 0.02	0.97	0.62	1.5 2	0.902
Occupation					

Student ^{RC}		1.00			
Job/Others	0.45	1.56	0.85	2.8 9	0.154
Living arrangement during COVID-19					
Living with family ^{RC}		1.00			
Living without family	- 0.79	0.45	0.26	0.7 9	0.005
Physical activity status during COVID-19					
No ^{RC}		1.00			
Yes	- 1.05	0.35	0.24	0.5 2	<0.001
Sleep duration during COVID-19					
>6h ^{RC}		1.00			
≤6h	- 0.47	0.63	0.42	0.9 3	0.020
Device of internet used during COVID-19					
Mobile/Tab ^{RC}		1.00			
Computer/Laptop	- 0.37	0.69	0.24	1.9 6	0.485
Both	- 0.19	0.83	0.52	1.3 1	0.421
Internet use experienced during COVID-19					
<2 years ^{RC}		1.00			
2–3 years	- 0.31	0.74	0.38	1.4 5	0.374
>3 years	- 0.89	0.41	0.22	0.7 8	0.007
Status of internet used during COVID-19					
Decrease ^{RC}		1.00			

Same	0.06	1.05	0.50	2.2 2	0.883
Increase	0.72	2.06	1.08	3.9 4	0.029
Daily internet use (Hour) during COVID-19					
$\leq 3h^{RC}$		1.00			
>3h	0.34	1.39	0.85	2.3 0	0.186

Discussion:

This study aimed to assess the prevalence of IA and the associated risk factors among adults in Makkah, Saudi Arabia during the COVID-19 pandemic. The findings indicate that the overall prevalence of IA among adults was 29.4%. Within this context, a study in Indonesia reported a 14.4% level of IA (**Siste et al., 2020**), while it was 36.7% in China (**Li et al., 2021**). This heightened IA among adults can be attributed to their home confinement, which has led to increased use of social and electronic media for information and entertainment (**Hossain et al., 2020; Siste et al., 2020**). The higher response from young adults in this study could also be responsible for the higher prevalence of IA. The introduction of online education (OE), particularly in the universities of Saudi Arabia may have boosted the use of the internet for academic purposes, thereby, increasing the risks of IA among young adults.

From the binary logistic regression, it is apparent that age, living arrangement, regular physical activities, sleep duration, internet use, and duration of internet use during the COVID-19 pandemic significantly influenced IA. In this study, it was observed that older people were less likely to be addicted to the internet than younger people. This may be related to that older adults in Makkah were more engaged in securing necessities for their family members, despite the imposition of social distancing (**Hossain et al., 2021**). In contrast, younger adults have experienced a rapid increase in internet use for academic purposes as well as for entertainment, including gaming, gambling, and pornography viewing (**Ela et al., 2021**).

The findings further suggested that living arrangements were a strong determinant of IA among adults in Makkah. A pre-COVID-19 study indicated that living with family

members reduced the possibilities of PIU (**Hassan et al., 2020**). In this study, interestingly, it was found that the risk of IA was lower among people living away from families during the COVID-19 pandemic; this could be because people living away from families might have been engaged in income-generating activities (IGAs) or alternative livelihood opportunities (ALOs) to survive during the hardship of the pandemic (**Ela et al., 2021; Hossain et al., 2021**).

This study found that IA was significantly lower among adults involved in regular physical activity. A Brazilian research has suggested that when individuals spent more time on physical activity, including walking, jogging, or running, to keep fit or stay healthy during the COVID-19 pandemic, they experienced fewer mental health issues such as anxiety and depression (**Puccinelli et al., 2021**), as they were pre-occupied with the activity. Moreover, regular physical activity improves self-control, which may reduce the risk of IA (**Park et al., 2016**). The findings further suggested that the prevalence and risk of IA were lower among adults who slept for less than or equal 6 hours per day. A previous study on university students in Bangladesh documented a strong association between mental health conditions with poor sleep quality during the COVID-19 pandemic (**Ahammed et al., 2021**). Participating adults with internet use experience of more than two years had a significantly lower risk of being internet addicted. Similar findings appeared in a previous study conducted in Ethiopia (**Zenebe et al., 2021**). The reason could be that long-time internet users may be busy with online-based work (**Hassan et al., 2020**). Participants whose internet use had increased during the COVID-19 pandemic were found to have high IA. Social media use has increased during the COVID-19 pandemic (**Hossain et al., 2020**), people have also been using the internet to pass time and watch different entertainment programs, which may have led to internet addiction.

Conclusion:

There is a high prevalence of IA among adults in Makkah, especially since the start of the COVID-19 pandemic. IA was found to be strongly linked to socioeconomic factors, such as age, and living arrangements, as well as behavioral factors, such as physical activity, sleep duration, use of the internet during the pandemic, and duration of daily internet use. This type of study is critical in countries like Makkah, Saudi Arabia. The findings of this study have substantiated the necessity and implementation of effective intervention programs. It may assist policymakers in identifying excessive internet users and reducing their overuse of the

internet. Appropriate preventive measures, such as teaching students and the public about safe internet use, and counseling those already addicted to the internet, are recommended. More interventions should strengthen self-control, build positive core self-evaluations, and optimize social adjustment, especially during emergencies. Finally, to properly assess IA in Bangladesh, more research is encouraged, particularly a nationally representative sample, in order to minimize non substance addiction.

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