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Smartphone Addiction and Symptoms of Brain Fog among Emerging Adults

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Abstract: *Smartphone addiction has become an increasingly common problem in the modern digital age of emerging adults. This compulsion over smartphones usually causes a break in daily routines, lowering productivity and creating tension in social relationships. The most concerning symptom is the emergence of brain fog, which manifests as a cognitive problem through symptoms like inability to focus, forgetfulness and mental exhaustion. Present research consisted of a single main study with a sample of (N = 321) participants, consisted of both men and women of age range 18 to 29 years, mostly were Rawalpindi and Islamabad's university students. All scales and sub-scales had alpha coefficients in an acceptable range. Pearson Product-Moment correlation showed that smartphone addiction was significantly and positively correlated with brain fog symptoms. Associations of the study variables with demographics, i.e. marital status, employment status and impact of trauma faced in the last 6 months, were also studied with the help of an independent sample t-test. Married individuals were found to score higher on smartphone addiction. Furthermore, unemployed individuals were significantly higher on physiological symptoms of brain fog. Along with it, those who faced trauma scored significantly high on brain fog and all three of its symptom domains.*

Key Words: Smartphone Addiction, Brain Fog Symptoms, Cognitive Symptoms, Physiological Symptoms, Psychological Symptoms, Emerging Adults, Marital Status, Employment Status, Trauma

Introduction

The high penetrative rate of smartphone usage has led to an extraordinary level of digital socialization, work and leisure. A growing apprehension has resulted from the increasing extent to which users may become dependent on their smartphones. Smartphones are now an integral aspect of modern life, and users enjoy connectivity, convenience, and entertainment. However, high smartphone usage has also caused concern over its adverse effects on physical and mental health. Smartphone addiction, also known as problematic cell phone use or cell phone dependence, is, therefore, an important and encompassing concept that needs to be examined. Consequently, smartphone addiction has been found to be a behavioral addiction that is a condition of concern that involves the habit of such specific apps. It may be compared with the other previously diagnosed behavioural dependencies, for instance, gambling addiction and internet addiction disorder generally. A study by Fabio et al. (2022) identified that around 6.6 billion people worldwide utilise smartphones; they use them for various purposes such as communication, web browsing, information gathering or sharing and entertainment. A survey revealed that from 2014 to 2020, problematic smartphone use increased at a high rate and will continue to increase, according to researchers (Olson et al., 2022).

Another survey by Andrews et al. (2015) explained that people use their smartphones, on average, 85 times per day, no matter what the time of day it is; it could be morning or afternoon, or even at midnight. Another study conducted by Mozes in 2012 reported that youths, on average, open their smartphone about 50 times every single day. A similar research was done by Deutsche Telekom AG in 2012, which reported that 91% of people never leave their smartphones at home when going out, and 46 % declared that they could not survive without their smartphones.

A study conducted in the United States shows that the utilization of smartphones has increased from 2011 at 35% to 2015 at 68%, and the reasons for this growth are multiple since smartphones are portable,

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easy to carry and can perform many purposes (Anderson, 2015). A survey conducted in India found that almost 9 out of 10 children possess a smartphone there. Although it is helpful for many purposes, it is also causing them to be psychologically addicted (Nayak et al., 2020). No doubt, with the help of the smartphone, life has become easier. One can check the news, weather, trade, maps, do shopping, gossip, set appointments, enjoy documentaries and movies, live-streaming people and much more from anywhere, even by sitting in bed. However, too much use and reliance on the smartphone is something wrong. According to Busch & McCarthy (2021), smartphone use is termed problematic when it begins interfering with and disturbing the daily lives of people, and it keeps on increasing over time.

Addiction towards smartphones has become such an important problem amongst youths and can prove to significantly destroy most components of their life. The use of smartphones, to an excessive extent, has been identified with plenty of undesirable effects, among them poor cognition, poor academics, and low mental status (Billieux et al., 2015). One of the most visible symptoms that have been witnessed with smartphone addiction is what is referred to as brain fog, a term used to describe cognitive problems that accompany memory loss, poor concentration and mental exhaustion. The ubiquitous nature of smartphone notifications and digital screens causes cognitive overload, making it challenging for an individual to pay attention and remember things (Rosen et al., 2014). Furthermore, addiction towards mobile phone usage has an impact on sleep patterns and deteriorates the cognitive deficiency associated with increasing chances of developing psychosomatic disorders such as anxiety and depression (Elhai et al., 2017). Smartphone addiction issues are solved by increasing awareness of the consequences, measures in which one tries to regulate the screen and fostering digital healthy habits in young adults (Montag et al., 2019). Internationally, several studies taken in different cultural backdrops have shown that smartphone addiction has had a negative impact on cognitive functions.

A meta-analysis by Niu et al. (2022) reported a significant negative correlation between smartphone addiction and cognitive abilities, including attention, working memory and executive function. This shows that excessive smartphone use might affect the performance of cognition, which might also cause symptoms of brain fog. Brain fog is researched mainly as a post-symptom of COVID-19 and came into existence as a cognitive impairment after that time. It is studied with physical and psychological problems but not with smartphone addiction. Smartphone addiction was also found to be high during COVID-19 since everyone has shifted to technology for their work, study and other day-to-day activities because of lockdown, and brain fog also came up after COVID-19. But the direct relation between them has not been studied till now. It contributes to knowledge on how such research can inform policies and interventions targeted towards promoting responsible smartphone use and reducing cognitive impairments among emerging adults in Pakistan, but similarly for those around the world.

Method

The study was cross-sectional and correlational survey research designed to study smartphone addiction and brain fog among emerging adults. It was also a comparative study between various demographic variables. In the current study, smartphone addiction was operationalized using the scores on the Smartphone Addiction Scale – Short version (Kwon et al., 2013). A high score on this scale indicates a higher level of smartphone addiction and vice versa, and brain fog was operationalized using the scores on the Brain Fog Scale by Atik & Manav, 2023. High scores on this scale and subscales (cognitive, physiological and psychological subscales) indicate higher levels of brain fog (and cognitive, physiological and psychological aspects of brain fog, respectively) and vice versa.

Instruments

The following instruments were used for the current study:

Demographic Sheet

For the current study, a demographic sheet was designed that consists of the following demographic related questions such as gender, age, marital status, employment status and trauma faced in last 6 months.

Smartphone Addiction Scale – Short version

This scale was developed by Kwon et al. (2013). It consists of a total of 10 items, each of which is scored on a 6-point Likert-type scale ranging from strongly disagree to strongly agree, with 1= strongly disagree, 2= disagree, 3= weakly disagree, 4= weakly agree, 5= agree, 6= strongly agree). There are no reverse-coded items, and it is a self-administered scale. This scale is frequently used to tap overall smartphone addiction and has good psychometric properties with Cronbach alpha (α) = 0.91 (Kwon et al., 2013).

Brain Fog Scale

This scale was developed by Atik & Manav (2023). It consists of a total of 30 items with three different subscales of different numbers of items. These three subscales are Cognitive Symptom subscales (items 1-17). Physiological symptom subscale (items 18-25) and Psychological symptom subscale (items 26-30). Each of them is scored on a 5-point Likert-type scale ranging from never to always, with 1=never, 2=sometimes, 3=undecided, 4=often, and 5=always. There are no reverse-coded items, and it is a self-administered scale. This is a newly developed scale used to measure brain fog symptoms and has good psychometric properties with Cronbach alpha (α) = 0.94 (Atik & Manav, 2023).

Sample and Procedure

The sample consists of (*N* = 321) emerging adults, mostly university students, both males (*n* = 158) and females (*n* = 163). The age of participants ranges from 18 to 29 (Emerging adults - Initially defined by Jeffrey Jensen Arnett, 2000). They were students of various private or government universities in Rawalpindi and Islamabad. The data was collected physically using a convenient sampling technique, and consent was taken from the participants both verbally and in written form. The inclusion criteria were emerging adults aged 18 to 29 who regularly use smartphones for a minimum of 2 hours per day. Students were taken from various academic disciplines and backgrounds to ensure diversity in the sample.

Participants were selected through convenient sampling after ensuring that inclusion criteria were met. A survey research design was employed to collect data from the participants. The scales of smartphone addiction and brain fog were administered physically. Data was collected from NUML Islamabad, International Islamic University, Arid Agriculture University, Quaid-e-Azam University and Riphah International University. Initially, permission was taken from university authorities for data collection. Before the concerned representatives of the target sample started, they were briefed about the purpose of the research, the voluntary nature of participation, and their right to withdraw at any moment during the study. They were told that their personal details would be kept confidential and that their privacy would be maintained.

After suitable rapport-building and verbal consent for participation in the research, the participants were provided with the questionnaire booklet, which consisted of a detailed informed consent form, a demographic information sheet, and two questionnaires. It took them approximately 10 to 15 minutes to complete the questionnaires. After getting the booklet back, they were thanked for their participation and cooperation.

Results

Table 1 demonstrates ranges, frequencies, percentages, means and standard deviations of the demographic attributes of the sample of the study. It depicts that males (49.2%) and females (50.8%) were almost in equal ratios but females were a little higher in proportion than males; most of the sample were unmarried and unemployed students. After that, we gather information related to whether they faced any trauma or grief in last 6 months.

Table 2 illustrates the correlation between smartphone addiction and brain fog and its subscales. Results show that there is a significant positive correlation between smartphone addiction and brain fog. It also shows that there is a significant positive correlation between the main variables and brain fog's subscales, i.e. cognitive subscale, physiological subscale and psychological subscale. Table 3 shows mean differences based on marital status across study variables. Scores indicate that married participants scored higher on all scales and subscales than unmarried participants. However, the differences are significant for smartphone addiction and non-significant for brain fog, cognitive, physiological and psychological subscales of brain fog. The effect size for smartphone addiction had a value of .64, indicating a medium effect size.

Table 4 shows mean differences based on employment status across study variables. Scores indicate that unemployed participants scored higher on all scales and subscales. However, the differences are significant for the physiological subscale of brain fog and non-significant for smartphone addiction, brain fog, and cognitive and psychological subscales of brain fog. The physiological subscale's effect size had a value of .33, indicating a medium effect size. Table 5 shows mean differences based on trauma faced in the last 6 months across study variables. Scores indicate that participants who faced any trauma or grief in a period of the last 6 months scored high on all scales and subscales. However, the differences are significant for the brain fog scale and cognitive, physiological, and psychological subscales of brain fog, and they are not significant for smartphone addiction. The results showed medium effect sizes.

Table 1

Demographic characteristics of our study (N=321)

Demographics	Range	*F*	%	*M (SD)*
Gender				
Male	-	*158*	49.2	-
Female	-	*163*	50.8	-
Age	18-29	-	-	*21.2 (2.28)*
Marital Status				
Married	-	*23*	7.2	-
Unmarried	-	*298*	92.8	-
Employment Status				
Employed	-	*42*	13.1	-
Unemployed	-	*278*	86.6	-
Experienced any kind of trauma/grief in the last 6 months?				
Yes	-	90	28.0	-
No	-	227	70.7	-

Note: f = frequency; % = percentage; *M* = Mean; *SD* = Standard Deviation

Table 2

Correlation Among Study Variables (N = 321)

S. No	Variables	1	2	3	4	5
1	SAS	-	.46**	.42**	.37**	.36**
2	BFS		-	.92**	.81**	.81**
3	COG			-	.57**	.65**
4	PHYSIO				-	.58**
5	PSYCHO					-

Note: SAS = Smartphone Addiction scale; BFS = Brain Fog scale; COG = cognitive subscale; PHYSIO = Physiological subscale; PSYCHO = Psychological subscale; *p < .05; **p < .01.

Table 3

Differences Across Marital Status on Study Variables (N = 321)

Measures	Married (*n* = 23)		Unmarried (*n* = 298)		*t*	*p*	95% CL		Cohen's *d*
	M	*SD*	*M*	*SD*			*LL*	*UL*	
SAS	39.00	9.34	32.86	9.53	2.98	.00	2.09	10.19	.64
BFS	76.45	23.16	73.95	18.25	.619	.53	-5.44	10.43	-
COG	41.49	12.29	41.14	10.47	.152	.88	-4.17	4.87	-
PHYSIO	22.35	8.19	20.30	6.43	1.44	.15	-.74	4.84	-
PSYCHO	12.61	5.11	12.51	4.30	.102	.92	-1.76	1.95	-

Note: SAS = Smartphone Addiction scale; BFS = Brain Fog scale; COG = cognitive subscale; PHYSIO = Physiological subscale; PSYCHO = Psychological subscale; CI = Confidence Interval; LL = Lower Limit; UL = Upper Limit.

Table 4

Differences Among Employment Status on Study Variables (N = 320)

Measures	Employed (n = 42)		Unemployed (n = 278)		*t*	*p*	95% CL		Cohen's *d*
	M	*SD*	*M*	*SD*			*LL*	*UL*	
SAS	32.02	9.22	33.50	9.71	-.926	.35	-4.62	1.66	-
BFS	69.71	18.59	74.84	18.58	-1.67	.09	-11.2	.93	-
COG	39.39	10.18	41.45	10.67	-1.17	.24	-5.51	1.39	-
PHYSIO	18.57	7.32	20.73	6.44	-1.99	.04	-4.29	-.02	.33
PSYCHO	11.75	4.50	12.65	4.32	-1.25	.21	-2.32	.51	-

Note: SAS = Smartphone Addiction scale; BFS = Brain Fog scale; COG = cognitive subscale; PHYSIO = Physiological subscale; PSYCHO = Psychological subscale; CI = Confidence Interval; LL = Lower Limit; UL = Upper Limit.

Table 5

Differences Along Trauma faced in last 6 months on Study Variables (N = 317)

Measures	Yes (*n* = 90)		No (*n* = 227)		*t*	*p*	95% CL		Cohen's *d*
	M	*SD*	*M*	*SD*			*LL*	*UL*	
SAS	34.02	9.25	32.88	9.71	.952	.34	-1.21	3.48	-
BFS	78.85	17.46	72.21	18.88	2.87	.00	2.09	11.16	.36
COG	43.18	9.60	40.39	10.97	2.11	.03	.19	5.38	.26
PHYSIO	22.32	6.78	19.67	6.37	3.28	.00	1.06	4.24	.41
PSYCHO	13.35	4.21	12.16	4.38	2.21	.02	.12	2.25	.28

Note: SAS = Smartphone Addiction scale; BFS = Brain Fog scale; COG = cognitive subscale; PHYSIO = Physiological subscale; PSYCHO = Psychological subscale; CI = Confidence Interval; LL = Lower Limit; UL = Upper Limit.

Discussion

The present study was undertaken to examine the relationship between smartphone addiction and brain fog symptoms among emerging adults in Pakistan. Moreover, the study investigated the impacts of different sociodemographic variables, including marital status, employment status and faced trauma in the last 6 months on study variables.

The research was conducted using a survey method, and a convenient sampling technique was used for data collection from private and public universities in Islamabad and Rawalpindi. In order to test the hypotheses, the Smartphone Addiction Scale by Kwon et al. (2013) and the Brain Fog Scale by Atik & Manav (2023) were employed. Collected data were then analyzed and interpreted by using Statistical Package for Social Sciences (SPSS-27). The percentages means, and frequencies of the demographic variables were calculated to gain knowledge of sample characteristics. Cronbach Alpha Reliabilities of measures were calculated, and the measures were found to be reliable and dependable. Descriptive statistics, including mean, standard deviation, actual and potential ranges of scales and subscales, were tabulated. Along with that, skewness and kurtosis for study variables were computed, and their values lay between -2 and +2, showing the normality of the data (Hair et al., 2010). Relationships among variables of the study were scrutinized by computing bivariate Pearson Product-Moment correlation along with an independent sample t-test.

The study stated that "smartphone addiction is positively associated with brain fog symptoms". This was supported by the finding, as there was a significant positive relationship between smartphone addiction and symptoms of brain fog (see Table 2). These findings are according to previous studies, which stated that cognitive functions can be impaired because of smartphone addiction; the signs include inattention, memory and executive function problems (Hadar et al., 2017). These deficiencies lead to brain fog, which describes a state of mental confusion and fuzziness of thoughts. More studies are being conducted to corroborate the findings of this research. Thomée et al. (2011) found that heavy mobile phone use was associated with more self-reported stress, sleep problems, and symptoms of depression, all of which are linked to cognitive functioning and brain fog. Therefore, cognitive functioning kept worsening

and worsening brain fog through stress and anxiety resulting from pervasive connectivity and social media exposure. Moreover, Demirci et al. (2015) found that problematic smartphone use was significantly linked with various forms of cognitive impairment, such as attention problems and decreased memory capacity. This association can be explained in several ways. Cognitive overloading and attention fragmentation follow from constant notifications and the need to multitask, disabling the brain from focusing and processing information clearly (Gauselmann et al., 2022). Moreover, extensive smartphone use, especially right before sleep, is believed to compromise sleep quality and hours as a result of emitting blue light from screens interferes with melatonin secretion and further increases cognitive impairments from sleep deprivation (Shmerling, 2020). Collectively, all these factors reveal how addiction to smartphones might lead to impairing the cognitive processes that lead to the symptoms described in brain fog.

Marital status has arisen as a major factor in understanding smartphone addiction. Findings indicate that married participants scored high on smartphone addiction compared to unmarried ones (see Table 3). Married people often have more responsibilities and stressors, such as work, family obligations and social expectations, which can lead them to use smartphones as a coping mechanism. This is based on the findings of other studies, which show that individuals with high-stress levels have higher smartphone addiction (Elhai et al., 2017). Also, married individuals may be using their phones more often to coordinate their family activities, manage house chores and communicate with their spouses and children, which may further explain their high addiction level (Jomy et al., 2019). Results showed non-significant differences between marital status regarding brain fog it may be that perhaps both married and unmarried experience similar extents of cognitive stressors contributing to brain fog, such as work pressure, social pressure or personal health problems (Marsh et al., 2014).

The results further indicated that unemployed participants scored more on smartphone addiction and brain fog than their employed counterparts (Table 4). Previous studies found mixed evidence regarding the employment status-related relationship with smartphone addiction. Some research findings show that some unemployed individuals might be using their cell phones more often as an approach to deal with boredom or unemployment stress (Elhai et al., 2019), which results similar to those in the present study. However, no significant difference in the present study is because of the pervasive influence of cell phones on people's lives, which hampers everyone irrespective of their employment status. The non-significant differences within the cognitive and psychological subscales suggest that employment status does not significantly affect those dimensions of brain fog. That may be because cognitive and psychological aspects of brain fog are more influenced by personality traits and other environmental factors rather than employment status in itself. The significant finding regarding the physiological subscale is particularly noteworthy. The unemployed people reported higher levels of tiredness, loss of energy and fatigue.

This concurs with the general literature that has stipulated the association of unemployment with more levels of physical symptoms and lesser overall health. Lack of structure in daily routines, social isolation, and financial stress all associated with unemployment could be factors contributing to higher levels of fatigue and loss of energy (McKee-Ryan et al., 2005).

Table 5 shows trauma exposure in the last 6-month duration was associated with high brain fog symptoms and smartphone addiction. The findings of this present study are in line with earlier studies that have made a record of the cognitive implications of trauma. Research shows that people who have exposure to traumatic events have highly reported cognitive impairments, mostly memory and attention challenges, that are core elements of brain fog. This research contributes to the body of knowledge specifically by pointing out the influence of trauma within a recent timeframe of six months, thereby suggesting that the effects can be immediate and quite strong on cognitive function (Bremner, 2006). Trauma causes varied mechanisms that relate to brain fog. The inflammation caused by stress leads to the deterioration of cognitive functions, as proved by studies on the impairment brought about by inflammation in the brain (Rohleder, 2014). Besides this, trauma can cause sleeping problems leading to deprivation and hence exacerbating the loss of cognitive abilities (Van Cauter et al., 2008). Psychologically, anxiety and depression that usually result from trauma also play a role in impairing cognitive functions (Wingo et al., 2010).

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