

Neuropsychological Sequelae of Problematic Social Media Use: Cognitive Fatigue, Behavioural Dysregulation, and Self-Esteem Erosion among Students of Government Graduate College for Women, Mohanpura, Rawalpindi

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ABSTRACT

Background: Problematic social media use has emerged as a significant public health concern, with mounting evidence linking excessive digital engagement to neuropsychological impairment in young adults. Cognitive fatigue, behavioural dysregulation, and self-esteem erosion represent core sequelae of chronic cyber-addiction, yet remain underexplored in Pakistani female college populations. This study aimed to map these neuropsychological consequences among students of Government Graduate College for Women, Mohanpura, Rawalpindi.

Methodology: An analytical cross-sectional study was conducted from January to September 2025 among 80 female students aged 17–25 years, recruited by non-probability convenience sampling. A semi-structured questionnaire was administered, incorporating the Social Media Addiction Scale (SMAS), Social Media Cognitive Fatigue Scale (CFS), Depression Anxiety Stress Scale (DASS-21), and Rosenberg Self-Esteem Scale (RSES). Data were analysed using SPSS v25 with descriptive statistics and chi-square tests.

Results: Most participants were urban (59%), bachelor's-level students from nuclear families (61%). Statistically significant associations were identified between social media addiction and type of family ($p<0.05$), poor sleep quality ($p=0.030$), perceived negative health effects ($p=0.001$), concentration difficulties ($p=0.005$), anxiety symptoms ($p=0.030$), and low self-esteem ($p=0.029$).

Conclusion: Problematic social media use is significantly associated with cognitive fatigue, behavioural dysregulation, impaired sleep, heightened anxiety, and self-esteem erosion among female college students, consistent with a neuropsychological sequelae framework. Digital literacy programmes, accessible counselling services, and structured screen-time management are recommended. Longitudinal research with diverse cohorts is needed to establish causality.

Keywords: Neuropsychological sequelae; problematic social media use; cognitive fatigue; behavioural dysregulation; self-esteem erosion; cyber-addiction; DASS-21; female students; digital well-being; Pakistan.

INTRODUCTION

The rapid expansion of digital technology has fundamentally transformed patterns of communication, learning, and recreation worldwide.¹ Social media platforms, while

offering opportunities for connectivity and information exchange, have also given rise to growing concern regarding excessive and maladaptive patterns of use.² In recent discourse, the term *brain rot* has been used to describe a perceived decline in cognitive sharpness and emotional stability associated with prolonged exposure to low-value or over stimulating digital content.² Although not yet a formal medical

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diagnosis, this concept reflects mounting public and scientific apprehension about digital overconsumption and its psychological implications.¹

Social media platforms are specifically engineered to encourage repeated engagement through reward-based mechanisms, including push notifications, algorithm-driven content feeds, and social-validation features such as likes and shares.³ Recurrent exposure to these stimuli may activate dopaminergic reinforcement pathways, contributing to habitual checking behaviours and difficulty disengaging from platforms.⁴ Over time, such compulsive usage patterns may progressively impair sustained attention, executive functioning, and emotional regulation.⁵

Globally, social media use has reached unprecedented levels, with billions of active users and steadily rising engagement among adolescents and young adults.¹ In Pakistan specifically, an estimated social media addiction prevalence of 29.5% has been reported among university-aged populations.⁶ Young women in academic settings may represent a particularly vulnerable subgroup, owing to developmental transitions, academic pressures, and sociocultural expectations regarding appearance and social comparison.⁷

Emerging research indicates that excessive social media use is significantly associated with anxiety, depression, sleep disturbance, and reduced self-esteem.^{4,8} Despite this growing body of evidence, the majority of published studies originate from Western or high-income contexts, and context-specific data from Pakistani female college students remain scarce.^{9,10} Understanding the neuropsychological sequelae of cyber-addiction within this demographic is therefore essential for the design of culturally appropriate and effective interventions.

The objectives of this study are to assess the association between problematic social media use with perceived cognitive fatigue, symptoms of anxiety, depression, and behavioral dysregulation, and self-esteem erosion among female students at Government Graduate College for Women, Mohanpura, Rawalpindi.

METHODOLOGY

An analytical cross-sectional study was conducted at Government Graduate College for Women, Mohanpura, Rawalpindi. Data collection was carried out between January and September 2025. The study population comprised female students aged 17–25 years enrolled at the college. All female students present during the data-collection period who provided written informed consent were included. The students with previously diagnosed psychiatric disorder (depression or anxiety, documented in medical records or self-reported at screening), were excluded from the study as these conditions could confound the associations of interest.

Using the WHO sample-size calculator (95% confidence interval, 10% margin of error, estimated addiction prevalence 29.5%)⁶, the required sample size was 80. Non-probability convenience sampling was employed.

A semi-structured, self-administered questionnaire with five sections was completed by participants under researcher supervision:

Section A – Socio-demographics: Age, academic discipline, education level, residence type, family type, sleep duration and quality, physical activity frequency, history of diagnosed psychiatric conditions, and perceived quality of life.

Section B – Social Media Addiction Scale (SMAS): A 15-item scale (Cronbach's $\alpha = 0.89$).¹¹ Scores: 15–30 = low risk; 31–45 = moderate addiction; 46–75 = high addiction with

serious life disruptions.

Section C – Social Media Cognitive Fatigue Scale (CFS): A 20-item scale covering cognitive overload, emotional exhaustion, reduced attention span, and compulsive use (Cronbach's alpha = 0.87).¹² Scores: 20–40 = low; 41–60 = moderate; 61–80 = high; 81–100 = severe cognitive fatigue.

Section D – DASS-21: A 21-item instrument measuring depression, anxiety, and stress (Cronbach's alpha = 0.88).¹³ Subscale scores are doubled before applying standard cut-offs: depression 0–9 = normal; anxiety 0–7 = normal; stress 0–14 = normal.

Section E – Rosenberg Self-Esteem Scale (RSES): A 10-item scale (Cronbach's alpha = 0.85)¹⁴, items 3, 5, 8, 9, and 10 are reversely scored. Total scores: 30–40 = high; 20–29 = moderate; 10–19 = low self-esteem.

The questionnaire was pre-tested on 4 students (5% of n=80) before full deployment, with minor wording adjustments made thereafter. Data were entered and analysed using SPSS version 25. Descriptive statistics (frequencies and percentages) summarised socio-demographic and key variables. Cross-tabulations and Chi-square tests examined associations between SMAS, CFS, DASS-21, and RSES categories.

Ethics: Approval was obtained from the Institutional Review Board (IRB) of Fazaia Medical College, Air University, Islamabad. Administrative permission was granted by the college. Participation was voluntary; informed consent was obtained from all participants. Data were used solely for research purposes, with anonymity and confidentiality maintained throughout.

RESULTS

Table I: Socio-demographic Characteristics of Respondents (n =80)

Characteristic	Category	n	%
Residence	Urban	47	59
	Semi-urban	14	18
	Village	19	24
Education Level	Intermediate	3	4
	Bachelor's	77	96
Academic Discipline	BS Chemistry	28	35
	BS English	25	31
	BS Economics	24	23
	FSC/Intermediate	3	4
Family Type	Nuclear	49	61
	Joint	31	39
Night Sleep Duration	<4 hours	2	3
	4–6 hours	25	31
	7–8 hours	44	55
	>8 hours	9	11
Physical Activity Frequency	Never	23	29
	1–2/week	20	25
	3–5/week	10	13
Previously Diagnosed Psychiatric Condition (depression/anxiety)	Daily	27	34
	Yes	0	0
Overall Quality of Life	No	80	100
	Poor	2	3
	Fair	39	49
	Good	39	49

Most respondents resided in urban with the remainder from villages and semi-urban settings. Nearly all were enrolled in bachelor's programmes. The majority lived in nuclear families. Most students reported sleeping 7–8 hours per night. Daily physical activity was reported by 34% in which walking was the most common form. No participants reported a previously diagnosed psychiatric condition. Quality of life was rated as fair or good by 97% of participants as shown in Table I.

Table II: Association of Social Media Addiction with other variables under study

Predictor Variable	Outcome Variable	<i>p</i> -value
Social Media Addiction	Type of family	< 0.05
Social Media Addiction	Sleep quality	0.030
Social Media Addiction	Perceived negative health effects	0.001
Social Media Addiction	Concentration difficulties	0.005
Social Media Addiction	Anxiety symptoms (DASS-21)	0.030
Social Media Addiction	Low self-esteem (RSES)	0.029

The table II shows significant associations between Social Media Addiction with family type, sleep quality, cognitive fatigue (as negative impact on health and concentration difficulties) and low self-esteem. There is also significant association between social media addiction and psychological behaviours like Anxiety, stress and depression.

DISCUSSION

The current study identified significant neuropsychological sequelae of social media use (cyber-addiction), including cognitive fatigue, behavioural dysregulation, and self-esteem erosion, among female college students. Higher level of social media use were associated with nuclear family type, poorer sleep quality, increased anxiety, concentration difficulties, and lower self-esteem, consistent with prior research demonstrating that excessive digital engagement negatively influences emotional stability and cognitive functioning.^{3,8}

Sleep disturbance emerged as a salient outcome. Prolonged screen exposure, particularly at night, has been shown to impair sleep duration and quality, subsequently affecting mood regulation and attention.¹⁵ The present findings support this relationship: preoccupation with social media appears to contribute indirectly to cognitive fatigue through disrupted sleep, consistent with

recent work demonstrating the serial mediating roles of sleep quality and fatigue in social media addiction.^{16,17}

Compulsive use was also associated with perceived negative health effects and heightened anxiety, aligning with evidence of a bidirectional relationship between psychological distress and problematic social media use.^{4,8} Individuals may initially use social media as a coping mechanism; however, excessive reliance may intensify emotional strain over time.¹⁸

Self-esteem erosion was significantly associated with prolonged social media engagement. Upward social comparison on digital platforms is known to undermine self-worth, particularly among young women.^{7,19} Repeated exposure to idealised content may therefore contribute to emotional exhaustion and reduced confidence.²⁰

While these findings highlight potential risks, it is important to note that social media use is not inherently harmful.³ Structured and purposeful engagement can yield positive outcomes, and the results instead indicate that maladaptive and excessive patterns of use are more strongly associated with adverse neuropsychological effects.⁸ Overall, this study supports a multidimensional understanding of problematic social media use, encompassing emotional distress, sleep disruption, and cognitive fatigue.² Longitudinal research with diverse cohorts is needed to clarify causality and to inform targeted preventive strategies within academic settings.¹⁶

CONCLUSION

This study demonstrates a significant association between cyber-addiction and markers of brain rot—including anxiety, stress, cognitive fatigue, nuclear family, poor sleep quality, and low self-esteem—among female college students. These findings have direct implications for academic performance and overall psychological health.

Addressing cyber-addiction warrants a coordinated response from educators, mental health professionals, families, and policymakers.

Specifically, institutions should consider introducing: (1) structured digital literacy programmes that teach healthy screen-time habits; (2) peer-led awareness campaigns about the psychological risks of excessive social media use; and (3) accessible counselling services for students showing signs of addiction or emotional distress. Policymakers may also explore platform-level regulations that promote healthier engagement defaults.

LIMITATIONS

The cross-sectional design precludes causal inference. The sample was restricted to a single women's college in Rawalpindi, limiting generalisability. The convenience sampling introduces selection bias, and self-reported data are susceptible to recall and social-desirability biases. Future longitudinal studies with larger, diverse, and mixed-gender cohorts are needed to establish causal pathways and identify gender-specific trends.

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