INTERNATIONAL JOURNAL OF SOCIAL SCIENCES BULLETIN
ISSN: (E) 3007-1917 (P) 3007-1909

Volume 4, Issue 6, 2026

SCREEN USE AND SLEEP QUALITY AMONG PAKISTANI YOUNG ADULTS: THE MEDIATING ROLE OF COGNITIVE AROUSAL

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DOI: http://doi.org/10.5281/zenodo.21289125

Received	Accepted	Published
24 April 2026	06 June 2026	21 June 2026

ABSTRACT

Growing concerns regarding excessive digital media engagement have highlighted its potential impact on sleep health. The present study examined the relationship between screen use and sleep quality and tested cognitive arousal as a mediating mechanism among young adults. A cross-sectional correlational research design was employed. The sample consisted of 600 university students of Pakistan aged 18–30 years (M_{age}= 20.42, SD = 1.82) recruited through purposive sampling. Participants completed the Media and Technology Usage and Attitudes Scale (MTUAS), Pre-Sleep Arousal Scale (PSAS), and Pittsburgh Sleep Quality Index (PSQI). Findings revealed that Screen use was positively associated with cognitive arousal (r = .09, p < .05) and poorer sleep quality (r = .14**, p < .01). Cognitive arousal was strongly and positively associated with poor sleep quality (r = .51***, p < .001) further revealing that cognitive arousal fully mediated the relationship between screen use and sleep quality. Findings suggest that interventions targeting pre-sleep cognitive arousal and limiting nighttime screen use may improve sleep quality among young adults.*

Keywords: *Screen use, sleep quality, cognitive arousal, young adults.*

INTRODUCTION

Digital technology has become an inseparable part of modern life, shaping how people communicate, learn, work, and spend their leisure time. Young adults are among the most active users of digital devices, often relying on smartphones, laptops, and tablets throughout the day. While these technologies offer unprecedented access to information and social connectivity, concerns have grown regarding their potential impact on health and well-being. In particular, increasing attention has been directed toward the effects of screen-based activities on sleep, a fundamental process essential for cognitive functioning, emotional regulation, and overall health.

A growing body of research indicates that excessive screen use, particularly during evening hours, may negatively affect sleep patterns. Exposure to digital devices before bedtime has been associated with delayed sleep onset, reduced sleep duration, poorer sleep quality, and increased daytime fatigue (Chang et al., 2015; Hale & Guan, 2015). Beyond the physiological effects of screen exposure, interactive digital activities such as social media engagement and media multitasking may heighten

mental stimulation and emotional involvement, making it more difficult for individuals to disengage from ongoing thoughts and transition into sleep (Levenson et al., 2017; Ophir et al., 2009). These findings suggest that the relationship between screen use and sleep may involve important psychological processes that warrant further investigation.

One psychological process that may help explain the relationship between screen use and sleep quality is cognitive arousal. Cognitive arousal refers to a state of heightened mental activity characterized by persistent thoughts, worry, rumination, and difficulty disengaging from ongoing cognitive processes before sleep (Harvey, 2002). Many forms of digital engagement, particularly social media use, online interactions, and exposure to emotionally stimulating content, require continuous attention and cognitive processing. Consequently, individuals may remain mentally alert long after screen use has ended, making it difficult to achieve the relaxed state necessary for sleep. Previous research has shown that bedtime media use is associated with increased pre-sleep cognitive arousal and poorer sleep quality (Exelmans & Van den Bulck, 2016). Similarly, frequent social media engagement has been linked with heightened psychological activation and sleep disturbances among young adults (Levenson et al., 2017). These findings are consistent with the broader literature suggesting that heightened cognitive activation before bedtime interferes with healthy sleep processes and may serve as an important pathway through which screen use influences sleep outcomes (Riemann et al., 2010).

The relationship between screen use, cognitive arousal, and sleep quality can be understood through established theoretical models of sleep disturbance. Harvey's Cognitive Model of Insomnia (2002) proposes that excessive cognitive activity, including worry, rumination, and persistent mental engagement, interferes with the ability to disengage from wakefulness and initiate sleep. According to this model, individuals who remain cognitively activated before bedtime are more likely to experience difficulties falling asleep and maintaining restorative sleep. Similarly, the Hyperarousal Model of Insomnia suggests that elevated levels of cognitive and emotional activation contribute to the development and persistence of sleep disturbances (Riemann et al., 2010). In the context of digital media use, screen-based activities may prolong mental engagement and increase cognitive stimulation, thereby elevating pre-sleep arousal and impairing sleep quality. Together, these theoretical perspectives provide a strong foundation for examining cognitive arousal as a potential mechanism through which screen use influences sleep outcomes among young adults.

Although previous research has consistently linked screen use with sleep-related difficulties, the processes through which digital media engagement affects sleep remain insufficiently understood. Much of the existing literature has focused on direct associations between screen exposure and sleep outcomes, with comparatively less attention given to the psychological mechanisms that may explain this relationship (Hale & Guan, 2015; Levenson et al., 2017). In particular, cognitive arousal has been identified as an important factor contributing to sleep disturbances (Harvey, 2002; Exelmans & Van den Bulck, 2016; Cellini et al., 2020). However, relatively limited research has examined whether cognitive arousal serves as a mediating mechanism through which screen use influences sleep quality. Furthermore, most available evidence originates from Western populations, and findings may not fully generalize to collectivistic societies where patterns of technology use, social interaction, and daily routines can differ considerably (Hale & Guan, 2015; Levenson et al., 2017). Given the rapid growth of digital media consumption among young adults in Pakistan, understanding the psychological pathways through which screen use influences sleep has become increasingly important. Therefore, the present study sought to examine the relationship between screen use and sleep quality while investigating cognitive arousal as a mediating mechanism among young adults.

Previous research consistently demonstrates a significant association between screen use and sleep disturbances among adolescents and young adults. Chang et al. (2015) found that exposure to light-emitting devices before bedtime delayed circadian rhythms and negatively affected sleep

quality and next-day alertness. Similarly, Hale and Guan (2015) reviewed multiple studies and concluded that increased screen time was associated with shorter sleep duration and poorer sleep quality. Research further indicates that excessive nighttime social media use predicts longer sleep latency and increased sleep disturbances among young adults (Levenson et al., 2017).

Numerous studies suggest that cognitive arousal is an important mechanism linking screen use to poor sleep outcomes. Exelmans and Van den Bulck (2016) reported that bedtime media use significantly increased pre-sleep cognitive arousal and reduced sleep quality among university students. Similarly, Scott et al. (2019) found that emotionally stimulating social media engagement heightened mental alertness and disrupted sleep processes. Research on media multitasking has also shown that excessive digital engagement impairs attentional control and increases cognitive overload (Ophir et al., 2009; Rosen et al., 2013).

The relationship between cognitive arousal and sleep quality is strongly supported by theoretical and empirical literature. According to Harvey (2002), excessive pre-sleep thinking, worry, and rumination interfere with the ability to relax and initiate sleep. Supporting this view, Riemann et al. (2010) proposed the Hyperarousal Model, emphasizing that heightened cognitive and emotional activation plays a central role in sleep disturbances. Moreover, Cellini et al. (2020) found that increased screen exposure during the COVID-19 lockdowns was associated with poorer sleep quality and heightened cognitive arousal.

Although previous literature has established important associations among screen use, cognitive arousal, and sleep quality, several limitations remain. Most studies focused primarily on social media or general screen exposure and relied heavily on cross-sectional designs, limiting causal interpretation. Furthermore, limited research has specifically examined the mediating role of cognitive arousal among young adults in collectivistic cultural contexts. Therefore, the present study aimed to investigate the relationship between screen use and sleep quality while examining cognitive arousal as a mediating mechanism among young adults.

Objectives of the Study

- To examine the associations between screen use, cognitive arousal, and sleep quality among young adults.
- To determine the extent to which screen use and cognitive arousal predicts sleep quality among young adults.
- To investigate the mediating role of cognitive arousal in the relationship between screen use and sleep quality among young adults.

Hypotheses

H1: Screen use will be positively associated with cognitive arousal among young adults.

H2: Greater screen use will be associated with poorer sleep quality among young adults.

H3: Higher levels of cognitive arousal will be associated with poorer sleep quality among young adults.

H4: Cognitive arousal will mediate the relationship between screen use and sleep quality among young adults, such that greater screen use will be associated with poorer sleep quality through increased cognitive arousal.

Material and Methods

Research Design

A cross-sectional correlational research design was employed to examine the relationships among screen use, cognitive arousal, and sleep quality among young adults. The design was appropriate for assessing associations among the study variables and evaluating the proposed mediation model within a naturalistic setting.

Participants

The sample comprised 600 university students (235 men and 365 women) aged between 18 and 30 years (M_{age} = 20.42, *SD* = 1.82). Participants were recruited through purposive sampling from various academic departments of public and private sector universities in Faisalabad, Pakistan. Eligibility criteria included being currently enrolled as a university student, falling within the specified age range, and providing informed consent to participate in the study. Young adults were selected because this developmental period is characterized by extensive engagement with digital

technologies and increased susceptibility to sleep disturbances associated with media use (Hale & Guan, 2015; Levenson et al., 2017).

Participants' demographic characteristics are presented in Table 1.

Table 1

Demographic Characteristics of the Participants (N = 600)

Characteristics	*M(SD)*	*f %*	*Characteristics*	*f %*
Age	20.42(1.823)			
Gender			**Education**	
Male		235 (39.2)	Under graduation	560 (93.3)
Female		365 (60.8)	Post-graduation	40 (6.7)
Screen Time			**Time Preference for screen use**	
Less than 1 Hour		31 (5.2)	Morning	16 (2.7)
1-3 Hours		179 (29.8)	Afternoon	46 (7.7)
4-6 Hours		194 (32.3)	Evening	186 (31.0)
More than 6 Hours		196 (32.7)	Night	352 (58.7)

Note. SD=Standard Deviation, M=Mean, f =Frequency, %= Percentage

Measures

All study measures were used in Urdu language.

Demographic Information Sheet

Participants completed a demographic information sheet designed to collect information regarding age, gender, educational level, university type, and other relevant characteristics. Information regarding participants' screen-use patterns and average daily screen time was also obtained.

Media and Technology Usage and Attitudes Scale (MTUAS; Rosen et al., 2013, Urdu Version; Present Study)

The Urdu version of the Media and Technology Usage and Attitudes Scale (MTUAS) was used to assess participants' patterns of media and technology use and attitudes toward technology. The scale comprises two components: Media and Technology Usage section containing 44 items and an Attitudes Toward Technology section containing 16 items. The usage section assesses the frequency of engagement in various digital activities, including smartphone use, internet searching, text messaging, phone calling, social media use, media sharing, television viewing, and online communication. Participants respond using Likert-type response formats reflecting the frequency of engagement in each activity, with higher scores indicating greater media and technology use.

The attitude section consists of four subscales: Positive Attitudes Toward Technology, Dependence on Technology, Negative Attitudes Toward Technology, and Preference for Task Switching. The original scale demonstrated satisfactory reliability, with Cronbach's alpha coefficients ranging from α = .70 to α = .92 (Rosen et al., 2013). In the present study, the Urdu version demonstrated excellent internal consistency for the Media and Technology Usage Scale (α = .92). The Attitudes Scale yielded a Cronbach's alpha of α = .52 in the pilot sample.

Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989, Urdu Version; Hashmi et al., 2014)

The Pittsburgh Sleep Quality Index (PSQI) was used to assess participants' subjective sleep quality during the previous month. The scale consists of 19 self-report items yielding seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component is scored on a scale ranging from 0 to 3, producing a global score ranging from 0 to 21, with higher scores indicating poorer sleep quality. The Urdu version validated by Hashmi et al. (2014) demonstrated satisfactory psychometric properties among Pakistani

participants, with an internal consistency coefficient of α = .77. The original version of the scale reported a Cronbach's alpha of α = .83 (Buysse et al., 1989).

Pre-Sleep Arousal Scale (PSAS; Nicassio et al., 1985, Urdu Version; Shahzadi & Ijaz., 2020)

The Urdu version of the Pre-Sleep Arousal Scale (PSAS) was used to assess pre-sleep arousal. The scale consists of 16 self-report items measuring two dimensions of arousal: Cognitive Arousal (e.g., racing thoughts, worry, and planning) and Somatic Arousal (e.g., physical tension and rapid heartbeat). Participants rate each item on a 5-point Likert scale ranging from 1 (not at all) to 5 (extremely), with higher scores indicating greater levels of pre-sleep arousal. The Urdu version translated and validated by Shahzadi and Ijaz (2014) demonstrated excellent psychometric properties among Pakistani university students, with an internal consistency coefficient of α = .87. The original scale also demonstrated good reliability (α = .84; Nicassio et al., 1985).

Procedure

The research proposal was approved by the Board of Studies of Department of Applied Psychology Government College University Faisalabad and Faculty Board. After approval data was collected from classrooms and common areas of participating universities following ethical guidelines. Participants provided informed consent, completed a demographic form, and responded to the Urdu versions of the MTUAS, PSQI, and PSAS. Instruments were administered in counterbalanced order, and researcher ensured standardized administration.

Ethical Consideration

Ethical approval for the study was obtained from the relevant institutional ethics review committee prior to data collection. Participants were informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any stage without penalty. Written informed consent was obtained from all participants before their inclusion in the study. To protect participants' privacy, responses were collected anonymously and treated with strict confidentiality. All data were used solely for research purposes and were stored in accordance with established ethical guidelines for psychological research.

Results

Table 2

Descriptive Statistics, Cronbach Alpha Reliability Coefficients and Pearson Product Moment Correlation of Study Measures (N = 600)

Variables	*M*	*SD*	*α*	1	2	3
1. Media and technology Usage	183.04	50.49	.91	-	.09*	.14**
2. Pre- Sleep Arousal Scale	39.45	11.95	.88	-	-	.51**
3. Pittsburgh Sleep Quality Index	15.62	7.88	.80	-	-	-

The results on table 2 indicate excellent reliability for the Media and Technology Usage scale. While the Pre-Sleep Arousal Scale and Pittsburgh Sleep Quality Index demonstrated good internal consistency. Generally, the psychometric analysis indicates that majority of the tools applied in the study exhibited reasonable reliability that indicated that they would be suitable in further statistical analyses. Moreover, findings of the Pearson Product Moment Correlation reveals that Media and technology usage significantly correlate

with pre-sleep arousal and sleep quality with small to medium effect size.

Table 3

Multiple Regression Analysis (Stepwise Method) Predicting Sleep Quality from Screen Use and Cognitive Arousal among Young Adults (N=600)

Variables	*B*	*SE*	*β*	*t*	*p*
Step 1					
Cognitive Arousal	.337	.023	.511***	14.508	.000
Step 2					
Cognitive Arousal	.332	.023	.503***	14.286	.000
Screen Use	.015	.005	.095**	2.685	.007

Note. Step 1: $R^2 = .261$, *Adjusted* $R^2 = .260$, $F(1, 595) = 210.49$, $p < .001$; *Step 2:* $R^2 = .270$, *Adjusted* $R^2 = .268$, $F(2, 594) = 109.95$, $p < .001$. *B = unstandardized regression coefficient; SE B = standard error; β = standardized coefficient; p values are two -tailed.*

Table 3 shows the results on stepwise multiple regression analysis to examine whether Screen Use and cognitive arousal predicted sleep quality. In Step 1, cognitive arousal significantly predicted sleep quality and explained approximately, 26.1% of the variance. In Step 2, screen use was added up into the model and significantly improved prediction, contributing an additional 0.9% of explained variance. The final model explained 27% of the total variance in sleep quality.

Table 4

Mediating Role of Cognitive Arousal between Media and Technology Use and Sleep Quality (N=600)

	M (CA)					Y (SQ)			
Antecedent	*B*	*SE*	*p*	*B*		*B*	*SE*	*p*	*β*
X (MTU)	.0210	.0097	2.1786	.0298	*c'*	.0040	.0024	1.6960	.0904
M (CA)	-	-	-	-	*b*	.0987	.0100	9.8296	.0000
			R^2=.008				R^2= .148		

*Note. (MTU) Media and Technology Use, (CA) Cognitive Arousal, (SQ) Sleep Quality *p<.05, ***p<.001.*

The mediation analysis was performed to determine whether cognitive arousal mediates the relationship between the media and technology use (screen use) and the sleep quality of the participants. The mediation analysis indicated that cognitive arousal significantly accounted for the association between screen use and sleep quality. Because the direct effect became non-significant after the inclusion of cognitive arousal, the findings are consistent with a pattern of full mediation. However, given the cross-sectional nature of the study, causal inferences cannot be drawn. Even so, mediation confirmation must be based on the bootstrapped indirect effect confidence interval.

Table 5

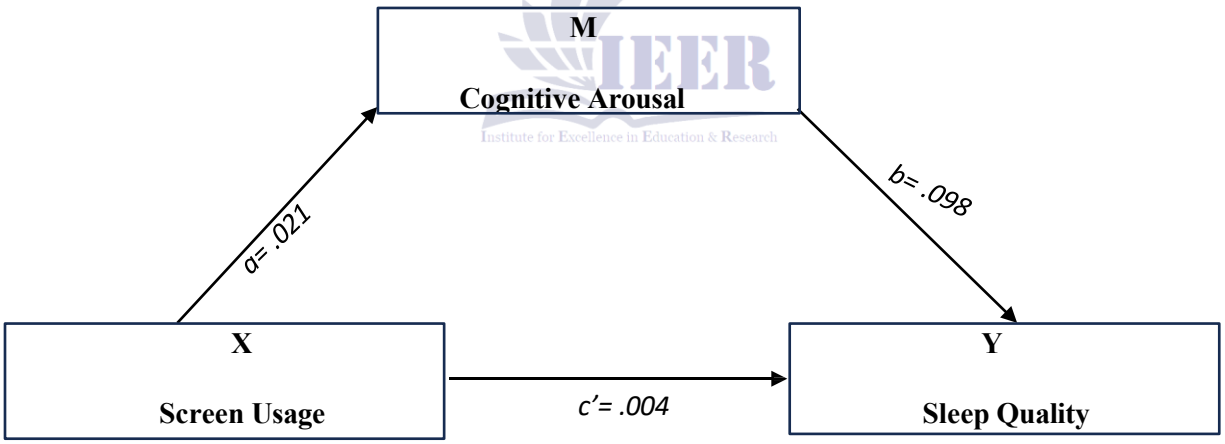
Total, Direct, and Indirect Effects of Media and Technology Use on Sleep Quality

Effects	Effect (B)	*SE*	*T*	*P*	95% *CI*	
					LL	*UL*
Total Effect	.0061	.0025	2.3950	.0169	.0011	.0111
Direct Effect	.0040	.0024	1.6960	.0904	.0006	.0087
Total Indirect Effect	.0332	.0167			.0018	.0657
Indirect Effect 1 (Ind1)	.0021	.0024			.0001	.0043

Table 5 is a summary of the total, direct, and indirect impacts of using media and technology on the quality of sleep. On the whole, the outcomes show that although media and technology use has a minor, yet, significant overall impact on sleep quality, this relationship seems to take place through some indirect mechanisms instead of the direct one.

Figure 1

Mediation Model Illustrating the Role of Cognitive Arousal in the Association Between Screen Use and Sleep Quality



Note. *a* = effect of screen use on cognitive arousal; *b* = effect of cognitive arousal on sleep quality; *c* = total effect of screen use on sleep quality; *c′* = direct effect of screen use on sleep quality after controlling for cognitive arousal. The total effect of screen use on sleep quality was significant (*c* = .006, *p* = .017). After including cognitive arousal in the model, the direct effect became non-significant (*c′* = .004, *p* = .090). The indirect effect through cognitive arousal was significant (*ab* = .002, 95% CI [.0001, .0043]), indicating full mediation. $p < .05$, $^{**}p < .001$.

Discussion

The present study examined the relationships among screen use, cognitive arousal, and sleep quality among Pakistani young adults. Consistent with the proposed hypotheses, screen use was positively associated with both cognitive arousal and poorer sleep quality, while cognitive arousal emerged as a significant correlate of sleep quality. More importantly, cognitive arousal mediated the relationship between screen use and sleep quality, suggesting that the influence of screen-based

activities on sleep may operate through heightened mental activation before bedtime. Although the associations between screen use and the study variables were relatively modest, they remain meaningful given the widespread nature of digital media use among young adults. Collectively, these findings contribute to a growing body of literature highlighting the psychological mechanisms through which technology use may influence sleep health.

The findings indicated that screen usage was significantly associated with poor sleep quality (see Table 2). This finding is consistent with previous research demonstrating that excessive screen exposure negatively affects sleep outcomes. For instance, Chang et al. (2015) found that the use of light-emitting electronic devices before bedtime delayed melatonin secretion, prolonged sleep onset, and reduced next-day alertness. Similarly, Hale and Guan (2015) reported that increased screen time was consistently associated with inadequate sleep duration and poor sleep quality among adolescents and young adults. Likewise, Levenson et al. (2017) observed that frequent social media use predicted greater sleep disturbances and poorer subjective sleep quality. Exelmans and Van den Bulck (2016) further reported that bedtime mobile phone use significantly predicted poor sleep outcomes among adults. Therefore, the present findings support the growing body of evidence suggesting that excessive technology use may disrupt healthy sleep patterns. However, the magnitude of the relationship between media and technology usage and sleep quality in the present study was relatively modest. This suggests that screen use alone may not fully explain sleep disturbances among young adults. Sleep quality is influenced by multiple biological, psychological, and environmental factors, including stress, mental health status, lifestyle habits, and circadian preferences (Buysse, 2014). Therefore, media and technology usage should be considered one of several contributing factors influencing sleep health.

Several mechanisms may explain this relationship. Exposure to blue light emitted from digital devices suppresses melatonin production and delays circadian rhythms, while engaging with stimulating online content may increase psychological activation and postpone bedtime (Chang et al., 2015). Consequently, excessive screen use may contribute to difficulties in initiating and maintaining sleep.

The results also demonstrated a significant positive relationship between screen use and cognitive arousal. This finding suggests that individuals who spend more time using digital devices experience greater mental activation before sleep. Similar findings have been reported by Cain and Gradisar (2010), who suggested that electronic media use promotes psychological stimulation and interferes with relaxation before bedtime. Likewise, Ophir et al. (2009) found that frequent media users experienced greater cognitive interference and difficulty disengaging from ongoing information processing. Vernon et al. (2015) also reported that extensive digital engagement was associated with increased cognitive overload and attentional difficulties. These findings indicate that digital technologies continuously expose individuals to information and social interactions that maintain cognitive activity even during periods intended for rest.

The relatively weak association observed in the present study may indicate that not all forms of screen use are equally disruptive. Educational or work-related technology use may have different psychological consequences than emotionally engaging activities such as social media use, gaming, or online communication (Twenge & Campbell, 2018). Future research should therefore distinguish between different forms of screen-based activities when examining their effects on cognitive functioning and sleep.

The relationship between screen use and cognitive arousal can be explained through Harvey's (2002) Cognitive Model of Insomnia. According to this model, excessive cognitive activity before bedtime, including worry, planning, and rumination, interferes with the ability to disengage from wakefulness and transition into sleep. Digital technologies provide continuous opportunities for interaction and information processing, thereby increasing mental alertness and cognitive activation. Consequently, individuals who engage heavily with technology may experience greater cognitive arousal before sleep.

The present study further found that cognitive arousal was significantly associated with poor sleep quality. This finding is consistent with previous literature emphasizing cognitive arousal as a central factor in sleep disturbances. Harvey (2002) proposed that intrusive thoughts and excessive mental activity interfere with sleep initiation and maintenance. Similarly, Riemann et al. (2010) argued that cognitive hyperarousal is a primary mechanism underlying insomnia and poor sleep quality. Furthermore, Nicassio et al. (1985) found that elevated pre-sleep cognitive arousal was strongly associated with sleep difficulties. Espie et al. (2006) also reported that excessive cognitive activation contributes significantly to persistent sleep problems. Thus, the present findings support the view that mental activation before bedtime is an important contributor to sleep quality.

Notably, cognitive arousal emerged as the strongest predictor of sleep quality in the present study (see Table 3). This finding suggests that pre-sleep cognitive activation may be a more immediate predictor of sleep difficulties than screen exposure itself. In other words, it may not simply be the amount of technology use that affects sleep, but rather the extent to which technology use stimulates ongoing mental activity before bedtime. This interpretation is consistent with the Cognitive Model of Insomnia, which proposes that excessive pre-sleep thinking, worry, planning, and rumination directly interfere with sleep initiation and maintenance (Harvey, 2002). Similarly, Espie et al. (2006) argued that heightened cognitive activity is a central mechanism underlying persistent sleep difficulties. Research by Nicassio et al. (1985) further demonstrated that individuals with elevated cognitive arousal report greater sleep disturbances, while Riemann et al. (2010) identified cognitive hyperarousal as a key factor contributing to poor sleep quality and insomnia. Therefore, the present findings suggest that cognitive arousal may represent a more proximal determinant of sleep quality than screen exposure alone.

The mediation analysis demonstrated that cognitive arousal significantly mediated the relationship between screen use and sleep quality (see Table 4 & 5; Figure 1). This suggests that excessive screen use contributes to poor sleep quality partly through increased cognitive activation. In other words, screen use appears to impair sleep because it keeps individuals mentally engaged before bedtime. This finding is consistent with Harvey's (2002) Cognitive Model of Insomnia, which proposes that cognitive activation serves as an important pathway through which environmental and behavioral factors influence sleep outcomes.

The mediation findings are also supported by previous empirical research. Cellini et al. (2020) reported that technology use negatively affected sleep through increased psychological stimulation and cognitive engagement. Levenson et al. (2017) further suggested that social media use may impair sleep through heightened psychological stimulation. Therefore, the present findings extend previous literature by demonstrating that cognitive arousal serves as an important mechanism linking screen use with sleep quality among Pakistani young adults.

Furthermore, the direct effect of screen use on sleep quality became non-significant after accounting for cognitive arousal, indicating that cognitive activation may represent an important explanatory pathway linking screen use and sleep outcomes. However, because the present study employed a cross-sectional design, caution should be exercised when interpreting mediation effects, as temporal and causal relationships cannot be established (Maxwell & Cole, 2007). Future longitudinal and experimental studies are needed to confirm the directionality of these relationships.

Within the Pakistani cultural context, these findings are particularly relevant due to the increasing accessibility of smartphones, internet services, and social networking platforms among university students. Young adults frequently use digital devices for educational activities, social interaction, entertainment, and communication, often extending screen use into late-night hours. Such patterns of technology use may increase cognitive engagement and reduce opportunities for psychological relaxation before sleep. Consequently, excessive screen use may place Pakistani youth at greater risk for sleep disturbances and associated psychological difficulties.

Conclusion

Overall, the findings of the present study showed that greater screen use was associated with increased cognitive arousal and poorer sleep quality among young adults. Cognitive arousal significantly mediated the relationship between screen use and sleep quality, indicating that excessive screen use may impair sleep through heightened mental activation. These findings highlight the importance of promoting healthy screen-use habits and sleep hygiene practices among university students. Interventions aimed at reducing pre-sleep cognitive activation may be particularly beneficial in improving sleep health among university students.

Study Implications

The present study contributes to the limited Pakistani literature by identifying cognitive arousal as a potential psychological mechanism through which screen use may influence sleep quality. Given the rapid expansion of digital technology use among Pakistani youth, understanding these mechanisms may assist researchers, clinicians, and educational institutions in developing culturally relevant interventions to promote healthy sleep behaviors.

The findings further highlight the importance of promoting healthy technology habits and sleep hygiene practices among young adults. Educational institutions and mental health professionals should encourage limiting screen exposure before bedtime and implementing strategies that reduce cognitive arousal, such as relaxation training, mindfulness exercises, and cognitive restructuring techniques. By addressing both excessive screen use and cognitive activation, interventions may effectively improve sleep quality and overall psychological well-being among young adults.

Strengths and Limitations

1. A large sample of young adults enhanced the reliability of the findings.

2. The study translated and validated three psychological scales in Urdu, contributing useful tools for future research.

3. The cross-sectional design limits causal interpretations.

4. Data were collected through self-report measures, which may be subject to response bias.

5. Despite these limitations, the findings provide valuable implications for future research and interventions related to screen use and sleep health among young adults.

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