

## EXPLORING THE RELATIONSHIP OF INTERNET ADDICTION WITH COGNITION, ATTENTION, AND QUALITY OF SLEEP AMONG STUDENTS: AN INSTITUTION-BASED CROSS-SECTIONAL STUDY

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### ABSTRACT

#### **Purpose**

*This study aimed to determine the correlation of Internet Addiction with Attention, Cognition, and Quality of Sleep among students.*

#### **Methodology**

*An Observational based Institutional Correlation study was conducted on 186 students using convenience sampling in the campus of a Health Science University. Outcome measures used were Internet Addiction Test (IAT), Brief Cognitive Rating Scale (BCRS), Mindful Attention Awareness Scale (MAAS), and Sleep Quality Scale (SQS) to measure Internet Addiction, Cognition, and Attention and Sleep quality respectively. Google form was circulated among the students and data was collected. A correlation analysis was done using Pearson Rank Correlation.*

#### **Results**

*The mean IAT score for the Mild Group was  $38.72 \pm 5.00$  and for the Moderate Group was  $61.00 \pm 9.22$ . The Mindful Attention Awareness Scale recorded scores of  $63.97 \pm 16.17$  and  $52.36 \pm 14.64$ , Cognition scores was recorded using the BCRS scale were  $8.00 \pm 4.03$  and  $9.07 \pm 4.57$ , Quality of Sleep was recorded using the QOS scale which showed the mean of  $62.67 \pm 12.36$  and  $67.64 \pm 18.26$  for the Mild and Moderate category respectively. This shows that there is a negative relation between Attention, Cognition and IA but there is a positive relation between Quality of Sleep and IA in Mild Category. Similarly, there is positive relation between IA and Attention, Cognition, Quality of Sleep in Moderate Category.*

#### **Conclusion**

*According to the findings, the factors were statistically insignificant yet showed a direct association. These relationships were clinically significant and interconnected. Despite its limitations, the study revealed important information about IA and its implications for medical students. The current study reveals that IA among the majority of medical students is a gloomy reality that needs a prompt response, underlining the importance of developing effective, targeted strategies to address these symptoms accompanying IA in students. Different study designs with higher sample sizes are also required to properly investigate the variables influencing Attention, Cognition, Sleep Quality, and IA among university students in India.*

**Keywords:** *Internet Addiction, Cognition, Quality of Sleep, Attention.*

### INTRODUCTION

Since the turn of the century, the use of the internet is increasing dramatically all over the world, especially in India with 624 million users as of January 2021, making it the second-largest online market after China. (1) There is an expected growth of Internet Users to about 900 million by 2025. (2) On the one hand, the internet has been beneficial in terms of increasing opportunities for

communication, information, education, and social interaction; nonetheless, inappropriate and unregulated usage by consumers has resulted in the emergence of Internet Addiction (IA). With the COVID-19 pandemic and lockdown situation, the dependence on the internet has increased exponentially, adopting a new style of work and study model. This has led to an increase in global concern over "Excessive Internet Use" and "Internet Addiction." Dr. Ivan Goldberg coined the term "Internet Addiction" in 1995 to describe pathological obsessive internet use (3). Internet addiction is defined as excessive or poorly managed biases, urges, or behaviors associated with computer usage and Internet access that can bring pain or suffering. (4) Widyanto et al. presented IA diagnostic criteria, including withdrawal, poor organizing ability, tolerance, focus, control dysfunction, and screen time as main symptoms. (5).

Internet addicts may utilize the internet for broadened periods, confine themselves from differing kinds of social contact, and concentrate nearly altogether on online activities instead of heaps of intensive life functions. (6) This can result in a variety of psychological, physical, and social difficulties, as well as reduced work performance, educational outcomes, bad food habits, migraine, vision problems, social withdrawal, and interpersonal difficulties. (7–9) Internet addiction has been linked to a number of mental illnesses, including substance abuse, cognitive deficits, depression, and stress. (10)

Previous research reveals that young internet users are more prone than older people to get hooked to the Internet. (9) Psychosocial and environmental aspects in college students' life might render them particularly vulnerable to IA. (11,12) Neuroimaging studies have shown that IA is linked to structural and functional alterations in brain areas involved in Executive Control, Decision-Making, Emotional Processing, and Cognitive Control. (13) For medical students, this can have serious consequences, hindering their learning and affecting their long-term professional objectives. Furthermore, it has the potential to have a widespread and negative influence on the quality of care that medical students deliver to patients and the broader community in the future. Hence, the goal of the current research is to find a correlation between Internet Addiction with Attention, Cognition, and Quality of Sleep which can aid in further understanding the impact of Internet Addiction on students.

## ***METHODOLOGY***

### ***Study Area and Study Sampling***

An Observational Based Institutional Cross-Sectional study was conducted to determine the correlation of IA with Attention, Cognition, and Quality of Sleep among students from December 2020 to May 2021. Individuals were enrolled if they matched the following inclusion criteria: 1) being between the ages of 18 and 25, 2) users have access to an e-mail or a social media platform, and 3) actively utilizing the Internet. Individuals with pre-existing medical conditions like insomnia, sleep apnea, which can affect the results were excluded from the current study.

The recruitment of participants was done using a response-driven convenience sampling approach. The final sample size of participants that participated in the study was 210 people, of which 186 satisfied the inclusion criteria and were included in the study.

### ***Research Instruments***

The following questionnaires were included in the web-based survey:

1. **Informed Consent:** An online Informed Consent Form was given in the survey at the start of the Google Form, where participants were asked permission for their participation and information was provided to them about the study.
2. **Baseline Demographic Questionnaire:** Age, Gender, Educational Status each of the participants was collected.
3. **The Internet Addiction Test:** The IAT is a 20-item self-reported scale that assesses the prevalence and severity of Internet addiction in people. Each item is evaluated from 0 to 5 on a 5-point Likert - type scale. The highest possible score is 100 points. The higher the score, the more severe the Internet compulsiveness and addiction. The IAT has high test-retest reliability ( $r = 0.85$ ) and great internal consistency ( $= 0.90-0.93$ ).
4. **Mindful Attention Awareness Scale:** The MAAS is a 15-item scale meant to test a key dispositional mindfulness feature, namely open or receptive awareness of and attention to what is happening in the present. Each item is scored from 1 (Almost Always) to 6 (Almost Never), and the scale is scored by taking the mean of the 15 items. Higher scores indicate greater dispositional mindfulness. According to the findings, the MAAS is a valid and accurate measure of mindfulness in undergraduates. The MAAS, in particular, had high Internal Consistency ( $= .92$ ), and all items demonstrated appropriate corrected item-total correlations.
5. **Brief Cognitive Rating Scale (BCRS):** This scale is used to measure functional and cognitive skills in both normal aging and dementia. Each domain is scored on a 1–7-point scale ranging from normal (rating of 1) to substantial impairment (rating of 7). Internal consistency was 0.74 on the scale.
6. **QOS (Quality of Sleep Scale):** The QOS, which consists of 28 questions, assesses six categories of Sleep Quality: Daytime Symptoms, Sleep Restoration, Problems Initiating and Maintaining Sleep, Difficulty Walking, and Sleep Satisfaction. Respondents indicate how frequently they display specific sleep behaviors using a four-point Likert-type scale (0-3). Total scores can vary from 0 to 84, with higher total values indicating more severe sleep issues. Yi and colleagues discovered an Internal Consistency of 0.92, Test-Retest Reliability of 0.81, and Good Construct Validity in an early psychometric study.

### ***Data Collection***

The participants were taken from the KAHER University, Belagavi, Karnataka, India. The core group members mirrored the university's diversity in terms of age range and educational level. After completing the questionnaire, all participants in the core groups were notified that they needed to recruit new volunteers for the research. Only after the network was considered incapable to develop further was the survey stopped. All of the information was collected and compiled using Google Forms.

### ***Data Analysis***

The Statistical Package for Social Sciences (SPSS) software version 23.0 was used for the statistical analysis. Descriptive analysis was performed using mean and standard deviation (SD) for continuous data and frequency with percentage for ordinal and nominal variables. The Pearson Correlation Coefficient was utilized to establish the relationship between IAT scores and MAAS, BRCs, and QOS scores. A P-value of less than 0.05 was deemed significant.

### ***Ethics Approval***

The current study's ethics permission was obtained and granted by the KAHER Institute of Physiotherapy's Institutional Ethics Committee (IEC No. 04/12/2020/525). Every participant was requested to provide online informed consent.

## **RESULTS**

A total of 210 medical students were assessed, with 186 of them meeting the inclusion criteria and taking part in the study. The average age of research participants was 20.83 years (SD = 1.70). There were 87.6% (n = 163) Females and 12.4% Males (n = 23). The mean years of online usage are 5.08 years (SD: 2.90). 91.3% of students used the internet for all three purposes includes Work, Study, and Entertainment. Students spent their Maximum no. of time on Instant Messaging ( $2.28 \pm 1.81$ ) and Minimum no. of time on activities relating to Online Auction ( $0.57 \pm 1.09$ ). The mean IAT score for the Mild Group was  $38.72 \pm 5.00$  and for the Moderate Group was  $61.00 \pm 9.22$ . The prevalence of Mild Internet Addicted students was 21.50% (n=40) and Moderate Internet Addicted students were 8.06 % (n=15) from the study sample. (Table 1)

Outcome measures evaluated in the study showed that the Mindful Attention Awareness Scale recorded scores of  $63.97 \pm 16.17$  and  $52.36 \pm 14.64$  for the Mild and Moderate category respectively. Similarly, the Cognition scores of Mild and Moderate addicted students using the BRCS scale were recorded as  $8.00 \pm 4.03$  and  $9.07 \pm 4.57$  respectively. Quality of Sleep was recorded using the QOS scale which showed the mean of  $62.67 \pm 12.36$  for Mild Category and  $67.64 \pm 18.26$  for Moderate Category (Table 2)

Further, to evaluate the correlation between the different variables of the study, we carried out correlation analysis between the total scores of IAT with MAAS, BRCS, and QOS for both the categories. The correlation coefficient of IAT and MAAS was done it showed a statistically insignificant result but showed a negative association ( $r = -0.07$ ,  $p = 0.673$ ) between IAT variables in the Mild Category and showed a positive linear association ( $r = 0.385$ ,  $p = 0.175$ ) in the Moderate Category. Similarly, the Cognition scores of Mild and Moderate Addicted students using the BRCS scale showed a negative correlation ( $r = -0.146$ ,  $p = 0.618$ ) between IA and Cognition in the Mild Category and a positive correlation ( $r = 0.055$ ,  $p = 0.740$ ) in the Moderate Category. Quality of Sleep was recorded using the QOS scale which showed that both the categories showed a positive correlation ( $r = 0.253$ ,  $p = 0.15$ ) for Mild Category and ( $r = 0.214$ ,  $p = 0.463$ ) for Moderate Category with IA. (Table 3)

## **DISCUSSION**

The current study investigated the Correlation of IA with Cognition, Attention, and Quality of Sleep among Students. This study included medical students between the age group of 18-25 years of a healthcare university, who were assessed for Cognition, Attention, and Quality of Sleep and were found to have an addiction to the internet. The current study discovered that while there is no statistically significant association between the variables, there is a clinically significant relationship between IA and Attention, Sleep Quality, and Cognition. The present study showed that 21.5% and 8.06% of students were mildly and Moderately Addicted to the internet respectively.

The correlation between IAT and MAAS was done and it showed a statistically insignificant result but showed a negative association between IAT variables in the Mild Category. This is due to the fact that they don't spend that much amount of time on digital devices which leads to severe attention deficits. Attention has shown a linear positive correlation with the Moderate category which shows that attention is affected and correlated positively with Internet Addiction. They may be because the capacity to multitask between different settings trains our brains to swiftly change

focus to the stream of pop-ups, prompts, and alerts, which may interfere with the ability to retain concentration on a specific cognitive job for an extended amount of time. The capacity of humans to accomplish everyday activities entails a mixture of two abilities: first, the ability to multitask and shift the focus between various tasks, and second, the ability to keep the focus on a certain issue. While digital multitasking is fantastic practice for shifting concentration, it can also impair the capacity to focus on one area for a lengthy amount of time. As a result, it may make a person more easily distracted since it diminishes one's capacity to ignore distractions, so decreasing their attention span. (14)

A systematic review done by Marin MG et al (15) reflected that IA and Attention are positively related to each other. They reviewed studies in which various tools were used to measure IA and compared it with Attention and other variables, and they found that having a higher level of IA increases problematic internet use and Attention deficits, and Subramanyam et al also discovered that having a higher level of Mindful Awareness significantly decreases Internet Addiction, which is consistent with the current study (6, 7)

The current study shows a statistically insignificant result and negative association between IAT scores and Cognitive Scores in the Mild Category. This could be because of mild addiction to the internet which doesn't affect the brain to a severe extent. For neural plasticity to occur there needs to be continuous and repetitive exposure to the task for a longer period of time to show any kind of change in the neural structure of the brain. (16)

The Cognition scores showed a positive correlation with IA in Moderate Category which is similar to the various studies conducted and it indicates that Compulsive Internet users show some cognitive deficits compare to people without such behaviors. In particular, there are reports of deficits in decision-making, inhibition, coping with emerging cognitive conflicts, working memory, task switching, and cognitive flexibility. (17) Because of its neuroplasticity, the brain is fairly pliable to external demands and stimuli, especially when it comes to learning new activities. Simple online interactions via the touchscreen interface of a smartphone have been found to cause permanent neurocognitive issues due to neurological alterations in cortical areas connected with sensory and motor processing of the hand and thumb. (18) Other environmental and biological variables, in addition to neuroplasticity pathways, might induce changes in the structure and function of the brain, leading to cognitive decline. Some new data reveals that switching from the "real world" to virtual environments might also cause negative neurocognitive alterations. A recent randomized controlled trial (RCT) discovered that six weeks of playing an online role-playing game resulted in a significant decrease in grey matter in the orbitofrontal cortex, an area of the brain regions involved in impulse control and decision-making for the brain development of children and adolescents, as many cognitive processes, particularly those related to higher executive functions and social cognition, are not entirely innate. Environmental influences, on the other hand, have a tremendous impact on them. (18) There are studies correlating cognition in adolescents that showed that the higher the score for problematic internet use, the higher the score for dysfunction related to emotional reactions in the family, and the higher the score for adolescents who used the internet had emotional problems and problems. Related to himself. (19) Sakarya et al. conducted a study on university students and found a significant relationship between the Cognition scores and the duration of weekly internet use. (20)

The current investigation found a positive linear relationship between students who had poor sleep quality and individuals with mild to moderate IA. This might be due to the fact that the blue light generated by digital screens can create a delay in the production of the sleep-inducing hormone melatonin, which improves awareness and resets the body's clock (or circadian rhythm). The

addicted behavior toward the internet causes a release of dopamine to boost the joyful experience, causing more dopamine to be released, which promotes attentiveness. Over time, even more of the activity is required to elicit the same pleasant reaction, resulting in a reliance on digital activity that increases arousal and delays the start of sleep. (21)

This is an especially serious issue for students whose circadian rhythms are already altering, forcing them to be up late at night. Lam et al. published similar findings in 2014, finding that 26.7 percent of individuals with IA also experienced sleep-related issues. Poor sleep quality is often linked to lifestyle behaviors, particularly internet use. Compulsive Internet use may have a negative impact on the sleep-wake cycle, resulting in insomnia and other sleep disorders. (22-23-24) Other research has revealed that problematic Internet usage is linked to sleep delays, abnormal sleep patterns, and excessive daytime drowsiness (24-25-26), all of which are linked to increased waking-time weariness. (27) A study of university students in Taiwan found that students with Internet Addiction had 1.4 times lower sleep quality than students without Internet Addiction. (28) Younes et al. observed a positive link between Internet Addiction and poor sleep quality in a comparable study done on university students in Canada. (29) A study of university students discovered that students with a sleep issue had higher mean Internet Addiction scale scores than students without a sleep disorder. (30) Furthermore, obsessive internet users frequently struggle with time management. When this circumstance is paired with people's habits of being online till late at night, it can lead to significant exhaustion, lack of sleep the next day, and negative consequences in academic and professional fields. (26-27-31)

### **CONCLUSION**

According to the findings, the factors were statistically insignificant yet showed a direct association. These relationships were clinically significant and interconnected. Despite its limitations, the study revealed important information about IA and its implications for medical students. The current study reveals that IA among the majority of medical students is a gloomy reality that needs a prompt response, underlining the importance of developing effective, targeted strategies to address these symptoms accompanying IA in students. Different study designs with higher sample sizes are also required to properly investigate the variables influencing Attention, Cognition, Sleep Quality, and IA among university students in India.

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**Table 1: Baseline Characteristics of Participants in the study.**

Sr.No.	Variables	Frequency (%) / Mean (SD)
1	Gender	
	Male      Female	23 (12.4%)    163 (87.6%)
2	Age (in years)	20.83 (1.70)
3	No. of years online	5.08 (2.90)
4	Maximum no. of time was spent on Instant Messaging (in hours)	2.28 (1.81)
5	Minimum no. of time was spent on Online Auction (in hours).	0.57 (1.09)
6	Total Screened	210
7	Total Participated	186 (88.57%)
8	IAT Score (Mild Group)	38.72 (5.00)
9	IAT Score (Moderate Group)	61.00 (9.22)
10	Mild Addiction	40 (21.50%)
11	Moderate Addiction	15 (8.06%)

**IAT- Internet Addiction Test****Table 2: Mean Scores of the Outcome Measures in the study.**

Sr.No.	Variables	Mean (SD)
1	IAT Score (Mild Group)	38.72 (5.00)
2	IAT Score (Moderate Group)	61.00 (9.22)
3	MAAS Score (Mild Group)	63.97 ± 16.17
4	MAAS Score (Moderate Group)	52.36 ± 14.64
5	BRCS Score (Mild Group)	8.00 ± 4.03
6	BRCS Score (Moderate Group)	9.07 ± 4.57
7	QOS Score (Mild Group)	62.67 ± 12.36
8	QOS Score (Moderate Group)	67.64 ± 18.26

**IAT- Internet Addiction Test, MAAS-Mindful Attention Awareness Scale, BRCS- Brief Rating Cognition Scale, QOS- Quality of Sleep Scale**

**Table 3: Correlation of IAT Score with MAAS, BRCS, and QOS scores for Mild and Moderate Category.**

	<b>VARIABLE</b>	<b>R VALUE</b>	<b>P-VALUE</b>	<b>RESULT</b>
<b>MILD CATEGORY</b>	IAT VS MAAS	-0.070	0.673	Non-Significant Non-Linear association
	IAT VS BRCS	-0.146	0.618	Non-Significant Non-Linear association
	IAT VS QOS	0.253	0.150	Non-Significant Linear association
<b>MODERATE CATEGORY</b>	IAT VS MAAS	0.385	0.175	Non-Significant Linear association
	IAT VS BRCS	0.055	0.740	Non-Significant Linear association
	IAT VS QOS	0.214	0.463	Non-Significant Linear association

**p value < 0.05 Statistically Significant.**

NO. OF TABLES: 3

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