Effect of Yoga Module on Quality of Sleep, Attention & Mobile Phone Dependence in School Students: A Randomized Control Trial

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Abstract

Background: For students aged 11 to 16 years, the estimated daily exposure to smartphones is approximately 1.5 hours, indicating an increasing trend in the amount of time spent in front of screens. Increasing use of screen time is associated with reduced sleep quality, symptoms of mental health, impair cognitive, emotional and attention disorders, decrease academic performance, poor quality of life and smartphone addictions.

Aims: The present study aimed to evaluate the effect of a structured yoga module on mobile phone dependence, attention, and sleep quality among school students.

Methods:

A total of 120 school students aged 11–16 years were randomly assigned to either a yoga group (n = 60) or a control group (n = 60). The yoga group underwent an 8-week structured yoga intervention (60 minutes/day, 6 days/week), while the control group continued their routine activities. Mobile Phone Dependence (MPD), sleep quality using the Pittsburgh Sleep Quality Index (PSQI), and attention using the Trail Making Test (TMT-A and TMT-B) were assessed at baseline and post-intervention. Data was analysed using mixed-design repeated measures ANOVA.

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Results:

The yoga group demonstrated a significant reduction in mobile phone dependence compared to the control group ($p < .001$). Sleep quality improved significantly in the yoga group, whereas the control group showed a decline ($p < .001$). Attention measures, including TMT-A and TMT-B completion time and errors, showed significant improvement in the yoga group, with minimal or no change observed in the control group.

Conclusion:

The findings suggest that a structured yoga module may serve as an effective non-pharmacological intervention for reducing mobile phone dependence, improving attention, and enhancing sleep quality among adolescents.

Keywords: Mobile Phone Dependence, Quality of Sleep, Attention, School Students, Yoga

Introduction:

Adolescence is an important phase of life characterised by rapid physical, mental, and emotional changes that shape behaviour and overall well-being.[1] During this time, the prefrontal cortex, which is responsible for attention, decision-making, and impulse

control, is still developing. Because of this ongoing maturation, adolescents are more prone to emotional fluctuations and difficulties in self-regulation.[2,3] Sleep plays a vital role in supporting these developmental changes, yet many adolescents do not get the recommended amount of sleep. This lack of adequate sleep often leads to sleep deprivation, which can negatively affect both cognitive functioning and emotional stability.[4,5]

In recent years, especially after the pandemic, the use of digital technologies has become an integral part of the daily lives of children and adolescents, leading to a sharp increase in screen-based activities. The childhood of today's generation is increasingly shaped by electronic devices such as smartphones. It is reported that 69% of children own a mobile phone, and by the age of 12 years, nearly 85% use it primarily for entertainment purposes.[6] Among children aged 11–18 years, the average daily smartphone exposure is approximately 1.5 hours, indicating a steady rise in screen engagement.[7]

Screen time, which refers to the amount of time spent using electronic devices, has become an increasing concern among young people. Extended use of mobile screens is closely linked to poor sleep quality [8,9], mainly because the blue light they emit interferes with melatonin production and disrupts the body's natural circadian rhythm.[10]

Moreover, evidence suggests that excessive smartphone use has been associated with several cognitive and emotional issues, including reduced memory, slower processing of information, weaker impulse control, and difficulty managing emotions.[11,12] It can also affect the functioning of the prefrontal cortex, resulting in decreased attention levels and fluctuations in mood.[13] It also contributes to reduced activation of the prefrontal cortex, leading to impaired attention and disturbed mood.[14] These factors are interrelated, forming a cycle where excessive mobile use disrupts sleep, which in turn impairs attention and overall well-being.[15]

In this context, there is an increasing need for interventions that are both effective and holistic. Yoga has emerged as a promising lifestyle-based approach that combines physical postures, breathing practices, and meditation. It has been shown to support mental health, improve emotional regulation, and enhance cognitive functions such as attention. [16–18] Research also indicates that yoga can help improve sleep quality, reduce stress levels, and promote overall well-being. [19,20]

However, despite increasing evidence, there is limited research examining the combined effect of Yoga on sleep quality, attention, and mobile phone dependence, particularly among school-going adolescents. Therefore, the present study aims to assess the impact of an integrated Yoga module on mobile phone addiction, sleep quality, and attention among students, along with its associated outcomes such as academic performance and overall well-being.

Objectives:

- To assess the role of the 2 months of yoga practice on the quality of sleep in frequently mobile users.
- To evaluate the role of 2 months of yoga practice on Mobile Phone Dependence (MPD) among frequent mobile users.
- To determine the role of 2 months of yoga practice on attention in frequently mobile users.

Materials And Methods

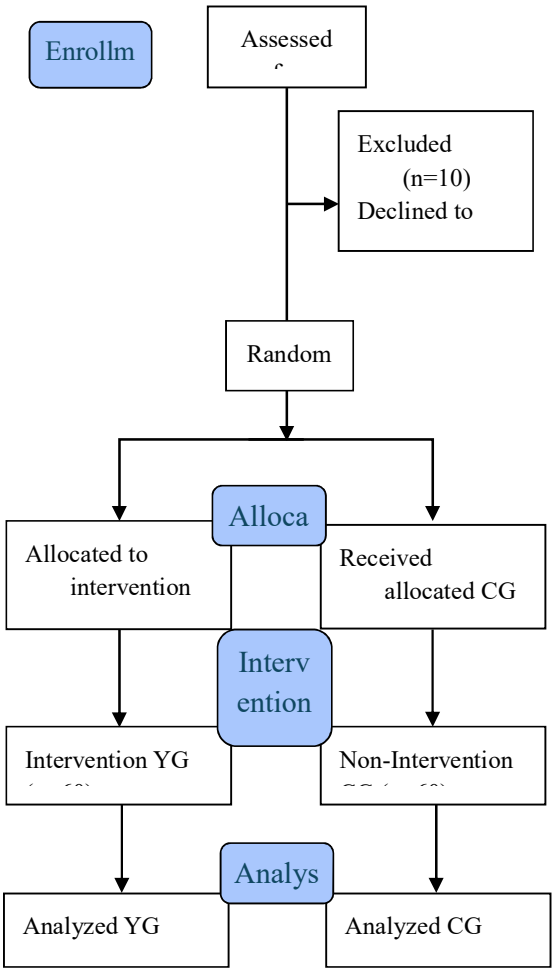
Study design and Sample size

The present study was designed as a parallel-group randomised controlled trial (RCT). A total of 120 school students aged between 11 and 16 years participated in the study. Participants were randomly allocated into two groups: the yoga group (YG) (n =

60; age ± SD: 14.07 ± 0.97 years) and the control group (CG) (n = 60; age ± SD: 13.12 ± 1.2 years). Randomisation was performed using an online tool (https://www.randomlists.com/team-generator), and allocation concealment was ensured using sealed opaque envelopes. Due to the nature of the intervention, blinding of participants was not feasible; however, outcome assessment was conducted using standardised self-report measures.

The required sample size was calculated using data from a previous relevant study related to a variable, i.e., Mobile Phone Dependence (MPD). With an effect size of (d) = 0.34, level of significance (α) = 0.05, power 1-β = 0.95, and required sample size of (n) = 115 was obtained using G* Power software version 3.1. [6]. Considering the possibility of dropouts, 130 participants were recruited for the study. However, 10 participants did not complete the study and had incomplete data; therefore, they were excluded from the final analysis. Thus, data from 120 participants were included. **Figure 1** presents the CONSORT flow diagram of the randomisation process.

Figure 1The CONSORT flow diagram depicts the recruitment process of the participants included in the study.



Participants and Recruitment:
Participants were recruited from Convent Public School, Saharanpur, Uttar Pradesh, an urban setting located in the northern region of India. Eligible students were screened based on predefined inclusion and exclusion criteria and were subsequently randomised into the respective groups.

Inclusion criteria
The following inclusion criteria were used for participant selection:

- Students aged between 11 and 16 years
- Both males and females
- Ability to read and understand Hindi and English
- Willingness to participate in the study

Exclusion criteria
Participants were excluded if they:

- Had undergone surgery in the last six months
- Were on regular medication
- Did not own a smartphone
- Had been practicing yoga regularly for the past six months
- Had a screen time of less than two hours per day

Ethical considerations
The study was approved by the Institutional Ethics Committee of the University of Patanjali, Haridwar (IEC number: UOP/IEC/2025/09). The study was also registered with the Clinical Trial Registry of India (CTRI/2025/08/092982).
Prior formal permission was obtained from the school principal before approaching the students. The aims and procedures of the study were explained to both the school administration and the participants in an age-appropriate manner. Participation was voluntary, and confidentiality of the participants' information was strictly maintained.

Intervention
The yoga intervention was conducted over 8 weeks (approximately 2 months). Each session lasted 60 minutes and was conducted daily (6 days per week), excluding Sundays and school holidays, under the supervision of a trained yoga instructor with over 10 years of experience. The sessions were conducted during school hours in a structured and supervised environment. The module was developed in accordance with protocols described in previous studies. [21,22] Each session followed a standardised sequence consisting of Sukshma Vyayama (loosening exercises), Asanas (postures), Pranayama (breathing techniques), and relaxation practices. Attendance was recorded to ensure adherence to the intervention, and only participants who attended at least 80% of the sessions were included in the final analysis. The control group continued their regular routine without any structured intervention. (For detailed Yoga module, see **Table 1**)

Table 1 Detailed Yoga Module

Component	Practice	Duration (min)
Pranayama	Bhastrika	3
	Kapalabhati	2
	Baahya	1
	Ujjayi	1
	Anulom Vilom	2
	Bhramari	2
	Udgeeth	2
	Pranav	2
Subtotal		**15**
Asanas	Mandukasana	3
	Shashakasana	3
	Vakrasana	3
	Gomukhasana	3
	Bhujangasana	3
	Shalabhasana	3
	Markatasana	3
	Dvi Chakrika (Cycling)	3
	Pavanamuktasana	3

	Paadavrittaasana	3
	Shavasana (Relaxation)	10
Subtotal		**40**
Sukshma Vyayama	Shoulder flexion, extension, rotation	3
	Elbow & finger movements	2
Subtotal		**5**
Total Duration		**60 minutes**

Outcome measures

Primary outcome

Mobile phone Dependence (MPD)

Mobile phone dependence was assessed using a structured questionnaire developed by Aggarwal et al. [23], based on the ICD-10 dependence syndrome criteria and the CAGE framework. The questionnaire consisted of 23 items, of which the first three assessed the duration and pattern of mobile phone use and were not included in scoring. This 20-item questionnaire evaluated behavioural aspects of dependence and was scored in a dichotomous format (Yes/No), with higher scores indicating greater mobile phone dependence. Content validity of the MPD scale was established through expert evaluation by 5 experts using a 4-point relevance scale, with a scale-level content validity index (S-CVI/Ave) of 0.88, indicating good content validity. Internal consistency was assessed using Cronbach's alpha, yielding values of 0.645 (pre) and 0.741 (post) for the control group and 0.676 (pre) and 0.634 (post) for the experimental group, indicating moderate to acceptable reliability.

Secondary outcomes

Sleep Quality

Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI) developed by Buysse et al. [24], a well-established and widely accepted self-report tool used to assess sleep patterns and related disturbances over the past month. Each of the 19 self-reported items of the questionnaire relates to one of seven subcategories: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, sleep medication use, and daytime dysfunction. The PSQI has demonstrated good reliability, with a Cronbach's alpha of approximately 0.83. It also shows strong validity, with reported diagnostic sensitivity of 89.6% and specificity of 86.5% in distinguishing between good and poor sleepers. Additionally, it has been validated across a wide range of clinical and non-clinical populations.[25]

Attention

Attention and cognitive functioning were assessed using the Trail Making Test (TMT) Parts A and B, a widely used and standardised neuropsychological assessment tool. TMT-A evaluates visual attention and processing speed. In contrast, TMT-B assesses higher-order executive functions such as cognitive flexibility and task-switching ability. Performance is measured based on the time taken (in seconds) to complete each part, with shorter completion times indicating better cognitive performance. The TMT has demonstrated good reliability, with reported test–retest reliability coefficients typically ranging from approximately 0.60 to 0.90 for both parts. It also shows strong validity, including good construct and criterion validity, and is widely used in both clinical and research settings to assess attention, processing speed, and executive functioning.[26]

Statistical analysis

Statistical testing was performed using SPSS Statistics version 21.0. Normality of data was assessed using the Kolmogorov-Smirnov test. Data were normally distributed. There were two groups (between factors, i.e., yoga and control) and two conditions (within factors, i.e., pre and

post). Therefore, to avoid multiple comparison type I errors, repeated measure analysis of variance (ANOVA) was performed for the analysis of the above-mentioned parameters. Results were considered statistically significant if $p \leq 0.05$. Additionally, effect sizes and percentage changes were calculated for all parameters. The formula used to calculate percentage change was as follows: ((post/pre) × 120-120).

Results

Participant Characteristics

Demographic details for the 120 participants who completed the intervention are presented in **Table 2**. The mean age of the participants was found to be mean ± SD of the Yoga group (14.07 ± 0.972) and the control group (13.12 ± 1.277). The distribution of participants by gender and class was comparable between the two groups.

Table 2 : Demographic details of the participants

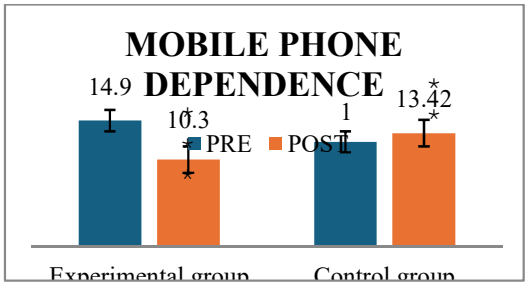
Variable	Category / Statistic	Yoga Group (n = 60)	Control Group (n = 60)
Age (years)	Mean ± SD	14.07 ± 0.972	13.12 ± 1.277
Gender	Male, n (%)	56.67 %	61.67 %
	Female, n (%)	43.33 %	38.33 %
Class / Grade	Class 6	3.33%	33.33 %
	Class 7	71.67 %	21.67 %
	Class 8	- -	26.67 %
	Class 9	25.00 %	18.33 %
Group Allocation	Total participants	60	60

Effect of Yoga on Outcome Measures

Mobile Phone Dependence (MPD)

The yoga group showed a significant decrease in MPD scores (14.90 ± 2.96 to 10.30 ± 3.11), whereas the control group showed an increase (12.40 ± 3.49 to 13.42 ± 3.87). The effect size was large (Cohen's d = 0.89). A mixed-design RM-ANOVA revealed a significant time × group interaction for mobile phone dependence, $F(1,118) = 123.62$, $p < .001$, indicating that the yoga intervention led to a significantly greater decrease in MPD compared to the control group. Post-hoc analysis confirmed a significant difference between the groups at post-test ($p = 0.005$). **Figure 2** shows changes in MPD scores across groups.

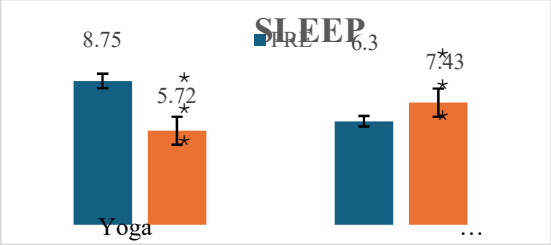
Figure 2 Graph of within-group difference for MPD.



Sleep Quality (PSQI)

Descriptive analysis showed that the control group observed a decline in sleep quality, with PSQI scores increasing from 6.30 ± 1.85 at baseline to 7.48 ± 2.23 at post-test. In contrast, the yoga group demonstrated a significant improvement, with scores decreasing from 8.57 ± 2.66 to 5.72 ± 2.19. A mixed-design RM-ANOVA showed a significant time × group interaction for sleep quality, $F(1,118) = 89.058$, $p < .001$, indicating a differential effect of the intervention. Post-hoc analysis also confirmed significant between-group differences at post-test ($p < .001$), with a large effect size (Cohen's d = 0.80). **Figure 3** shows changes in PSQI scores across groups.

Figure 3 Graph of within-group difference for PSQI



Attention (TMT A & B)

For TMT-A, participants in the yoga group showed a clear decrease in completion time (41.90 ± 17.24 to 31.38 ± 11.99) and errors (1.12 ± 1.09 to 0.35 ± 0.61), reflecting improved attention and processing speed **(See figures 4 & 5)**. In contrast, the control group showed little to no meaningful change over time. A similar pattern was observed for TMT-B. The yoga group demonstrated a significant decrease in completion time (77.03 ± 26.37 to 53.92 ± 16.42) along with a reduction in errors (1.77 ± 1.10 to 0.77 ± 0.96), whereas the control group showed minimal improvement **(See figures 6 & 7)**. Post-hoc analysis confirmed that the yoga group performed significantly better than the control group at post-test for TMT-A time ($p < .001$), TMT-A errors ($p = .003$), and TMT-B time ($p < .001$), while differences in TMT-B errors were not statistically significant. The observed effect sizes ranged from moderate to large ($d = 0.71–1.06$), indicating a meaningful positive effect of the yoga intervention on attention.

Figure 4 Graph of within-group difference for TMT-A (Time)

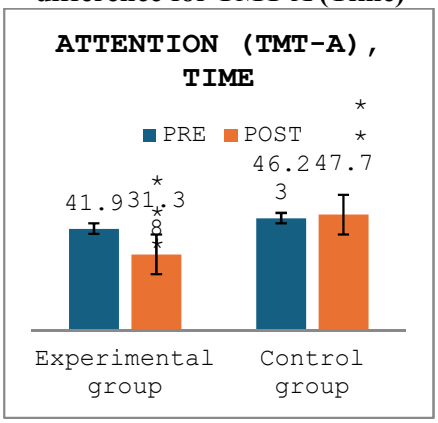


Figure 5 Graph of within-group difference for TMT-A (Error)

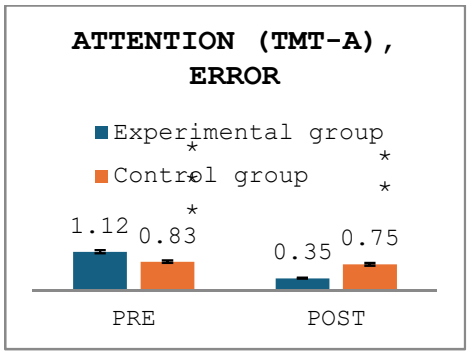


Figure 6 Graph of within-group difference for TMT-B (Time)

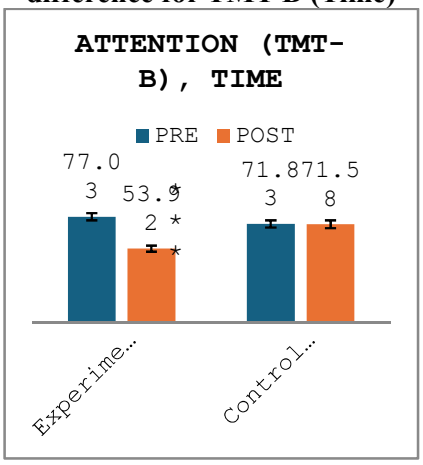
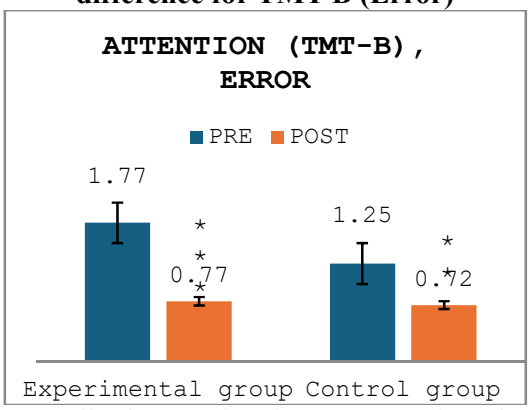


Figure 7 Graph of within-group difference for TMT-B (Error)



Overall, the results demonstrate that the yoga intervention significantly improved mobile phone dependence, sleep quality, and attention compared to the control group, with consistent and meaningful effect sizes across all outcome measures. For detailed changes, see **Table 3**.

Table 3: Changes in Outcome measures (Mean ± SD)

Parameters	Yoga group				Control group			
	Pre	Post	% age change	Effect change	Pre	Post	% age change	Effect change
MPD	14.90 ±2.96	10.30 ±3.11	-1.48	1.52	12.40 ±3.49	13.42 ±3.87	8.22	0.28
PSQI	8.75± 2.65	5.72± 2.19	-49.82	1.25	6.30± 1.85	7.48± 2.22	-18.70	0.58
TMT-A Time	41.90 ±17.24	31.38 ±11.99	-25.10	0.71	46.23 ±21.26	47.7± 22.59	3.17	0.07
TMT-A Error	1.12± 1.091	.35 ±.606	-68.75	0.001	.83 ±.886	.75 ±.856	-9.63	0.000
TMT-B Time	77.03 ±26.37	53.92 ±16.42	-30	1.05	71.83 ±18.64	71.58 ±20.33	0.34	0.02
TMT-B Error	1.77± 1.10	0.77± 0.96	-56.49	0.96	1.25± 1.13	0.72± 0.80	-42.4	0.55

Discussion

The present study aimed to evaluate the effectiveness of a structured Yoga module in reducing mobile phone dependence, improving attention, and enhancing sleep quality among school students. The findings demonstrate consistent improvements across all three domains in the yoga group compared to the control group. These results suggest that yoga-based interventions may help address dependence, cognitive, and sleep-related concerns in adolescents.

Mobile Phone Dependence

These findings are consistent with research showing that yoga enhances self-regulation and awareness.[16,27] Since excessive smartphone use is often habitual, practices involving breath awareness and mindful movement may help interrupt automatic behaviours and improve control.[28] Emotional regulation may also contribute, as adolescents often use smartphones to cope with stress.[29] Studies have reported reductions in smartphone use following yoga-based interventions.[30–32] However, as MPD was assessed using a self-reported tool, the findings should be interpreted cautiously.

Sleep Quality

The results indicated an improvement in sleep quality in the yoga group, whereas the control group showed a decline. The significant interaction effect suggests that the intervention was associated with meaningful changes in sleep patterns. These findings are also supported by earlier literature linking excessive smartphone use with poor sleep patterns.[33,34] Evening smartphone use may disrupt melatonin production and delay sleep.[35] Yoga also improves sleep by reducing stress and enhancing autonomic balance.[36,37], as well as increasing GABA levels associated with relaxation.[38] However, given the short duration and use of subjective measures, long-term effects require further investigation.

Attention

The findings from the Trail Making Test (TMT) also suggest improvements in attention, processing speed, and cognitive flexibility in the yoga group, while the control group showed minimal change. This indicates that yoga may positively influence cognitive functioning in adolescents. These results are consistent with previous studies showing improvements in attention following yoga interventions.[39–41] Yoga also strengthens executive functioning and reduces internal distractions.[42,43] In contrast, the lack of improvement in the control group aligns with evidence linking excessive smartphone use to reduced attention.[44,45] However, other factors such as motivation and environment may also influence these outcomes.

Conclusion

The findings of the present study suggests that a structured yoga module may be beneficial in modern-day challenges faced by adolescents, such as mobile phone dependence, poor sleep quality, and reduced attention. Students who participated in the yoga intervention demonstrated improvements across behavioural, cognitive, and sleep-related outcomes compared to those who followed their usual routine. However, the findings should be interpreted in light of certain limitations, including the use of self-reported measures, the single-school (urban) sample, and the relatively short duration of the intervention. Future research with larger and more diverse populations, along with long-term follow-up, is needed to further validate these findings. Overall, the study highlights the potential role of yoga as a supportive, non-pharmacological strategy for promoting healthier lifestyle behaviours and overall well-being among school-going adolescents.

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